The Wolves of Yellowstone: The first 15 years 1995-2010

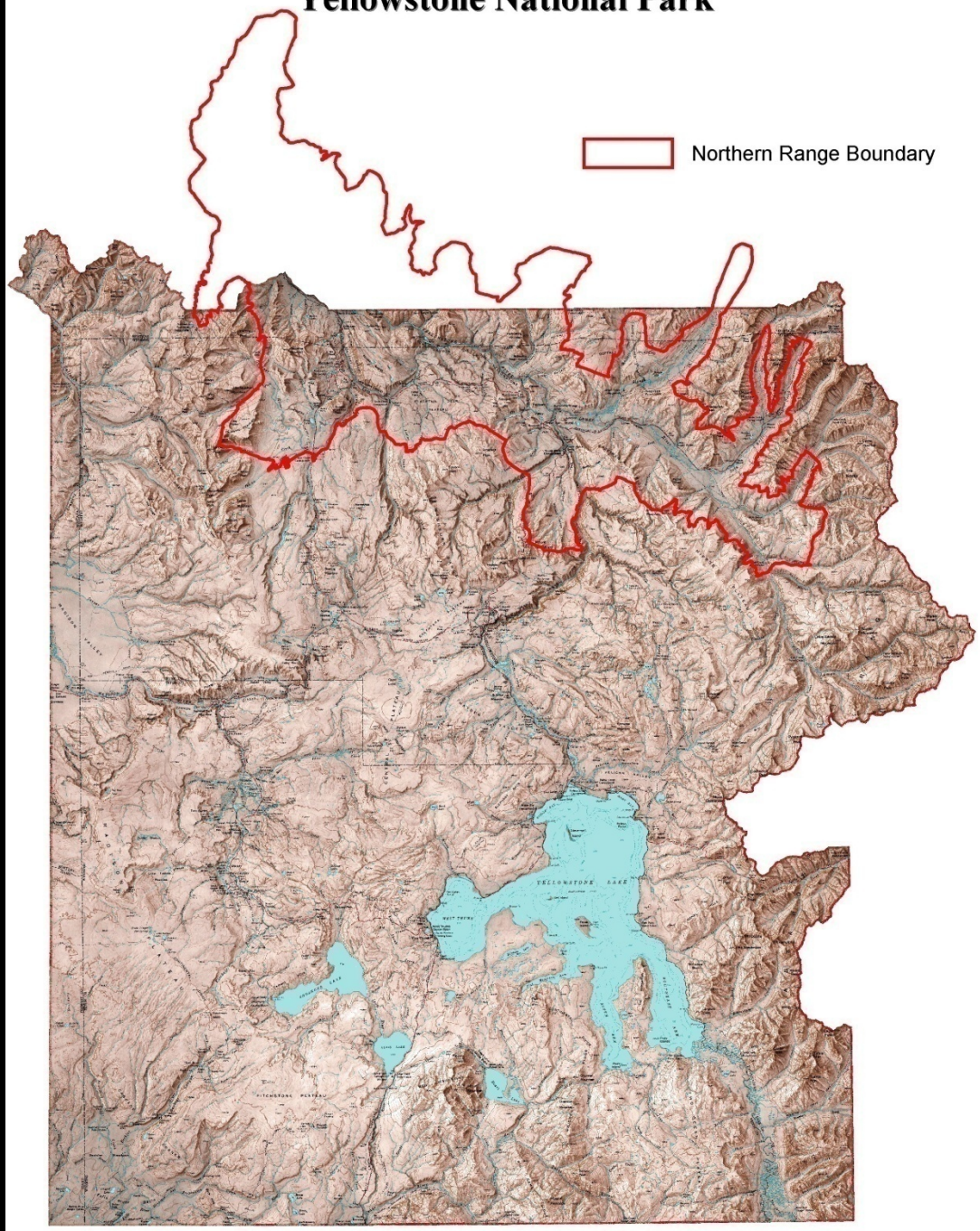
Yellowstone Wolf History

1872-1926	Wolves Present
1926	Last Wolf Killed
1926-1994	Wolves Absent
1995	14 Wolves from Alberta, Canada
1996	17 Wolves from British Columbia, Canada
1997	10 Wolves from NW Montana
2010	End of Phase I

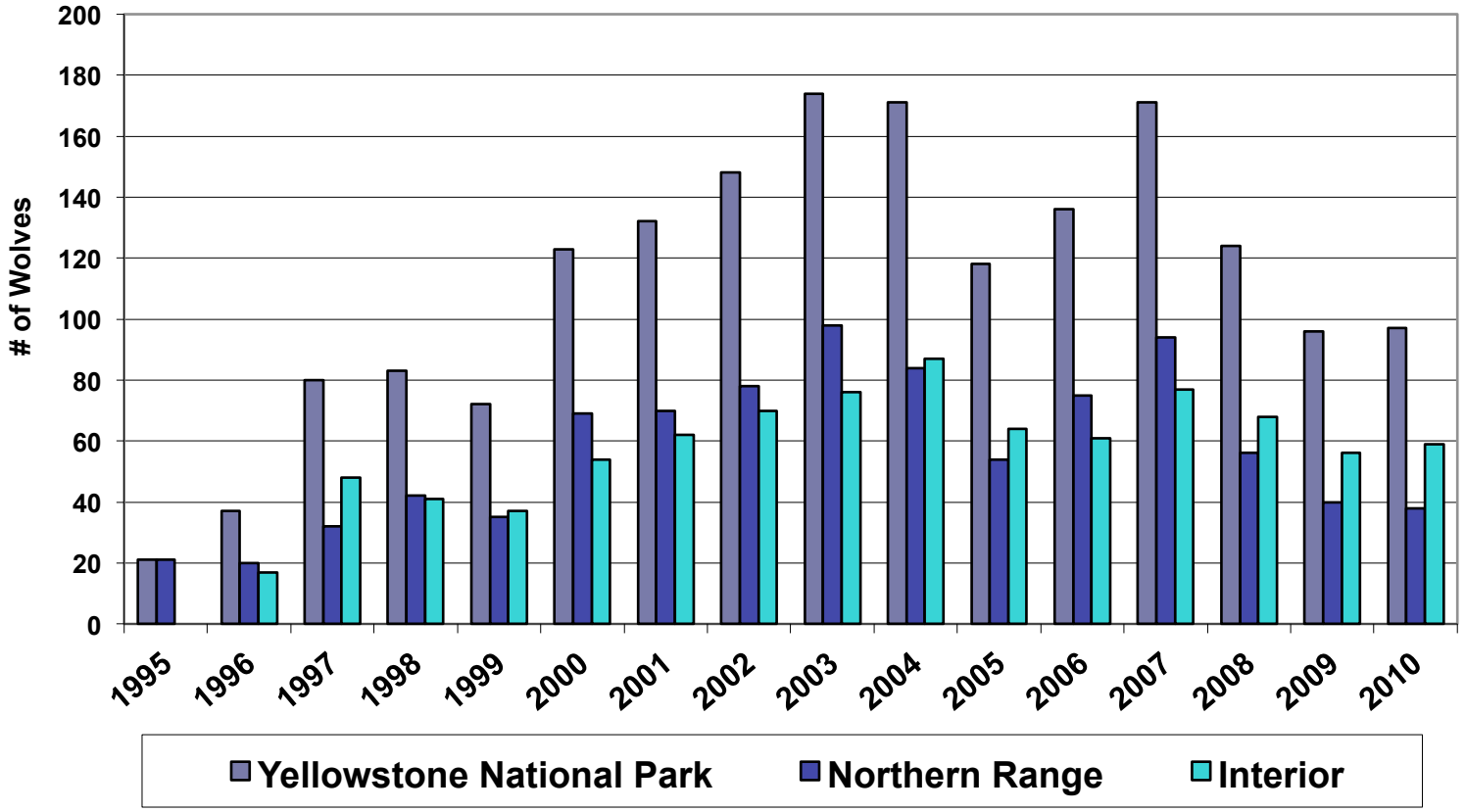
REINTRODUCTION


U.S.
FISH & WILDLIFE
SERVICE

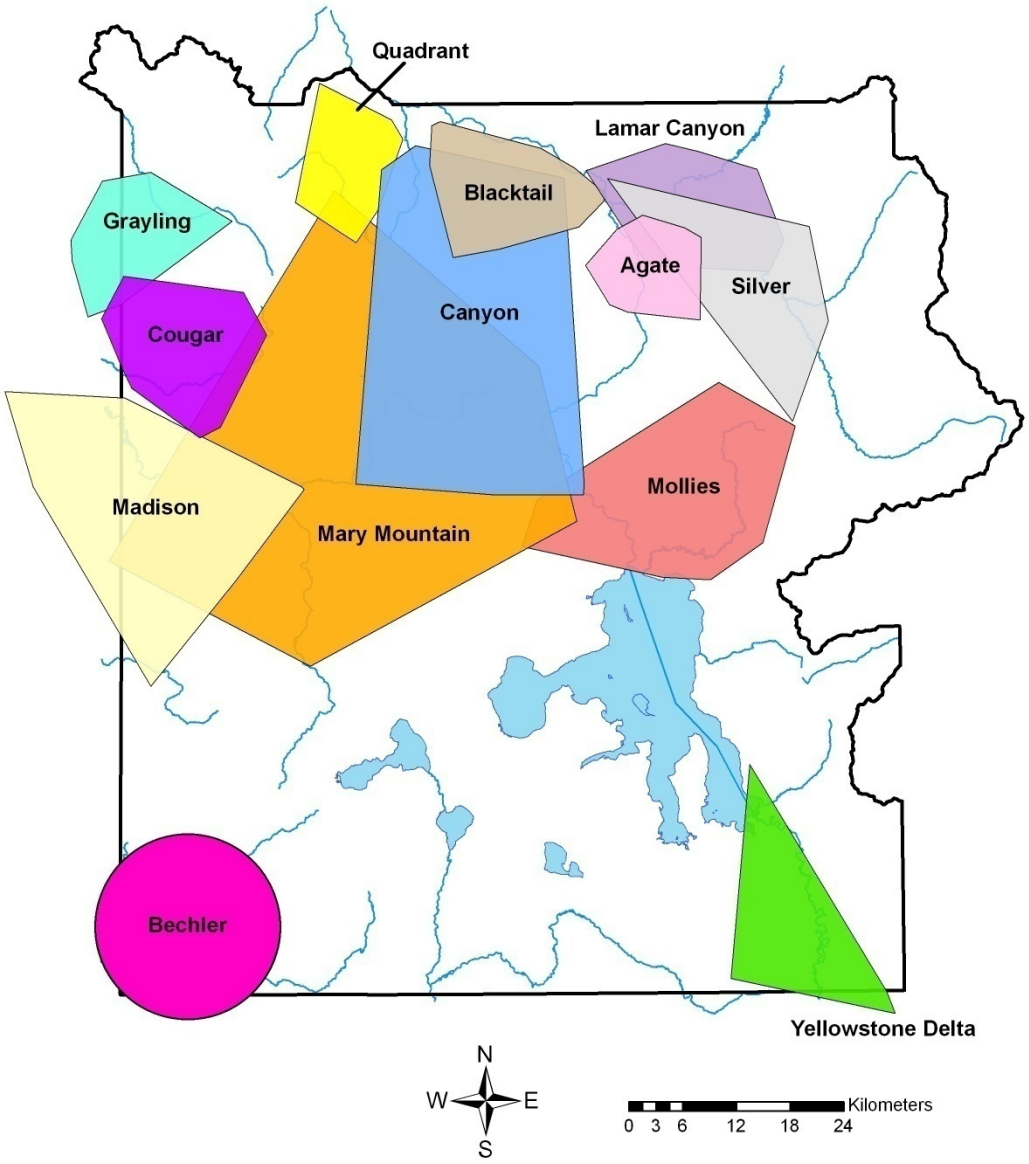
Yellowstone National Park



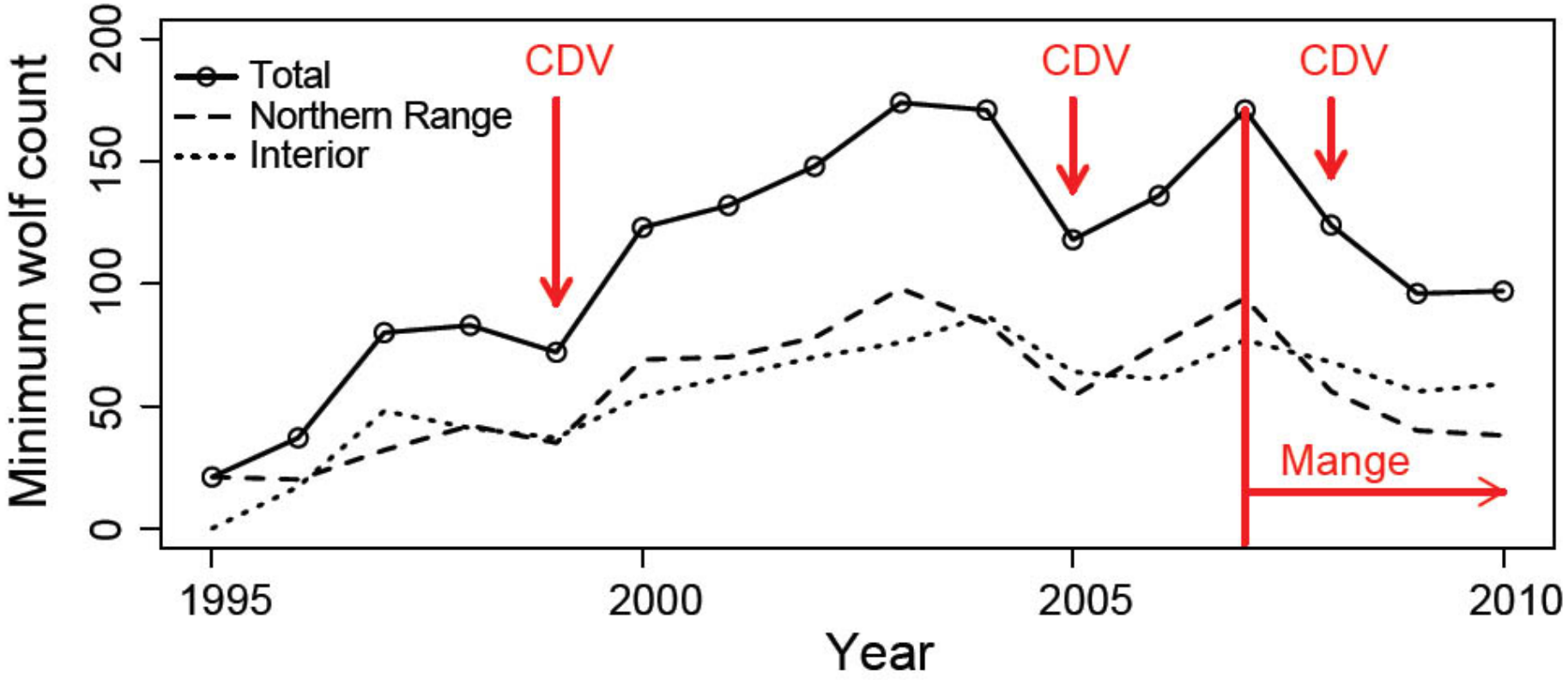
Yellowstone National Park Wolf Population 1995-2010



2010 Yellowstone Wolf Pack Territories

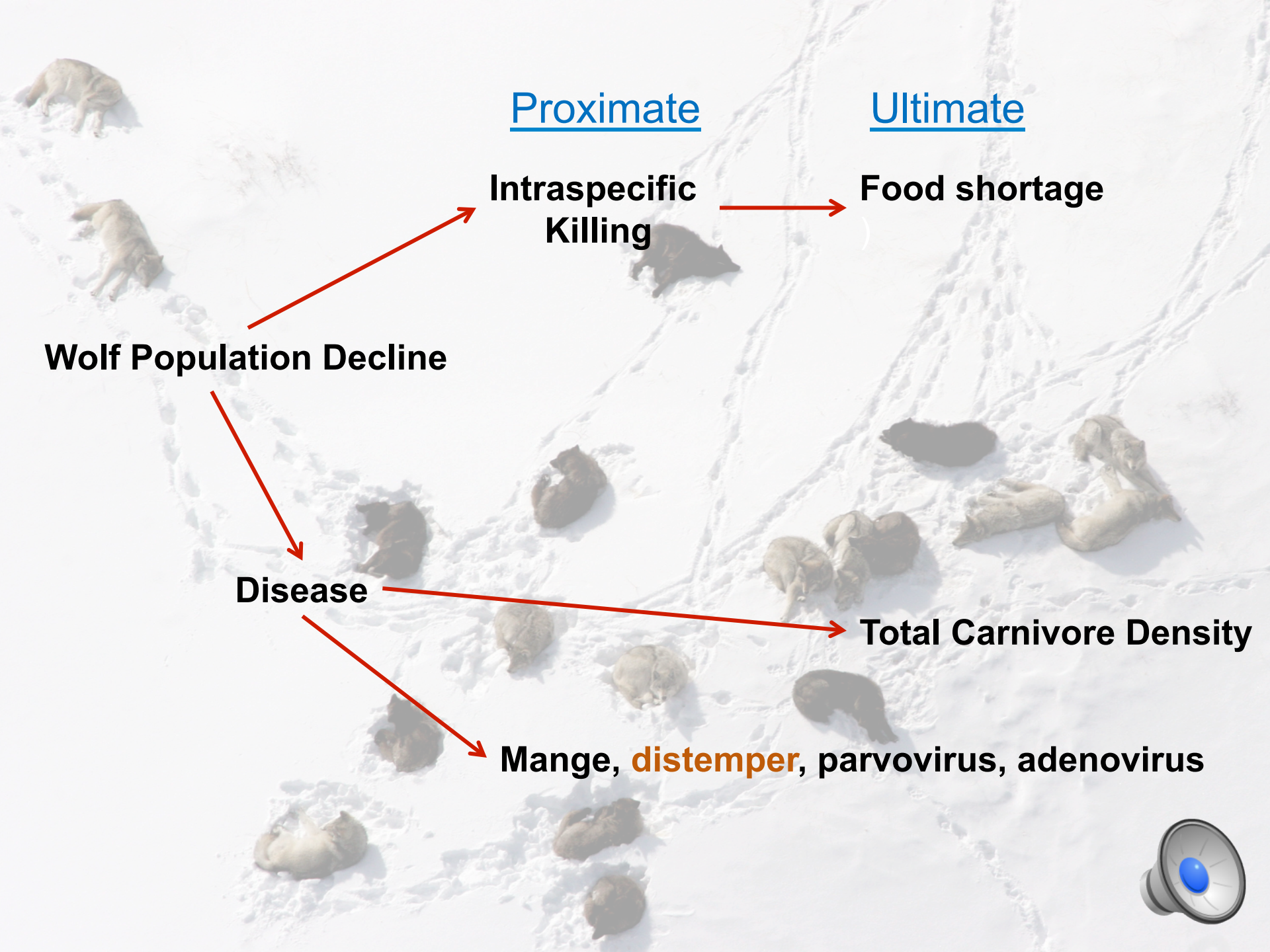



F1
F2
F3
0.1
15.9


Minimum wolf count
0
50
100
150
200
Total
Northern Range
Interior
CDV
CDV
CDV
Mange
1995
2000
2005
2010
Year

YELL - #204M
bite to crest & tooth wear

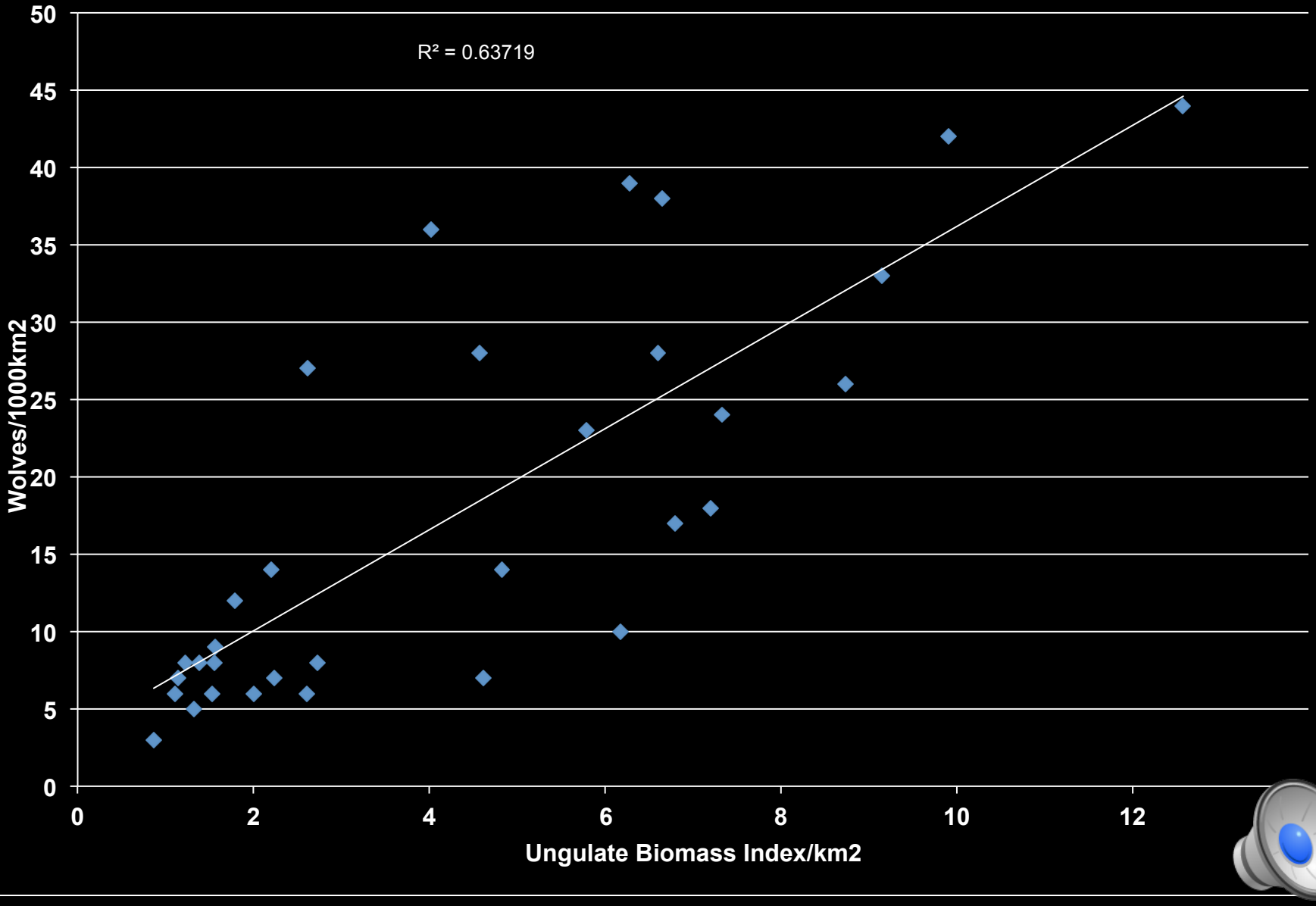
YELL - #152F
…there are bite marks on palate


Proximate
Ultimate
Intraspecific Killing
Food shortage
Wolf Population Decline
Disease
Total Carnivore Density
Mange, distemper, parvovirus, adenovirus

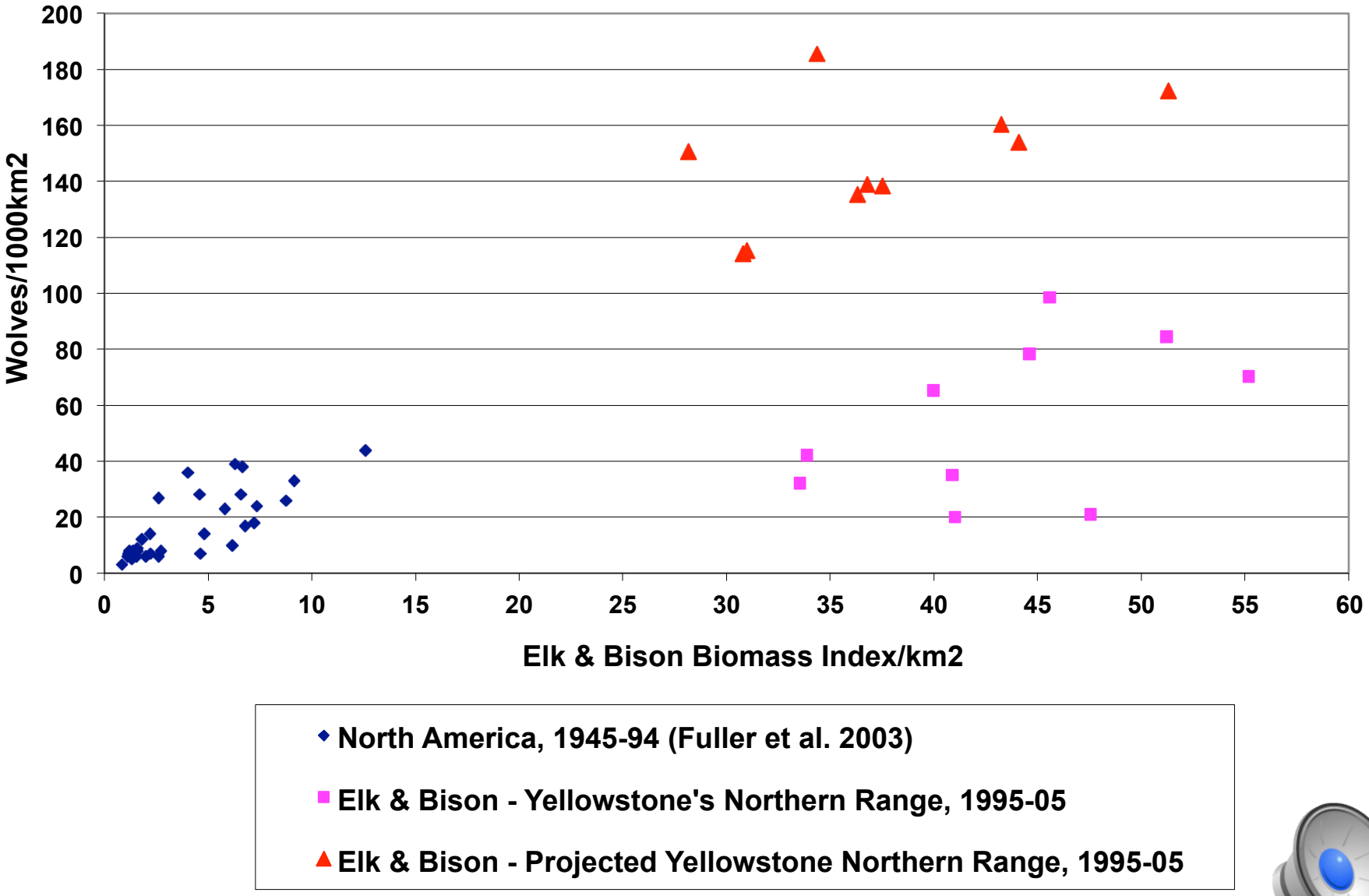
Population Regulation in Wolves

- Wolf density is thought to be controlled by extrinsic factors
- "…64% of variation in wolf density is accounted for by biomass"
- "…a plot between food and abundance does not 'level off' and suggests that this relationship is valid for higher densities Fuller et al. 2003

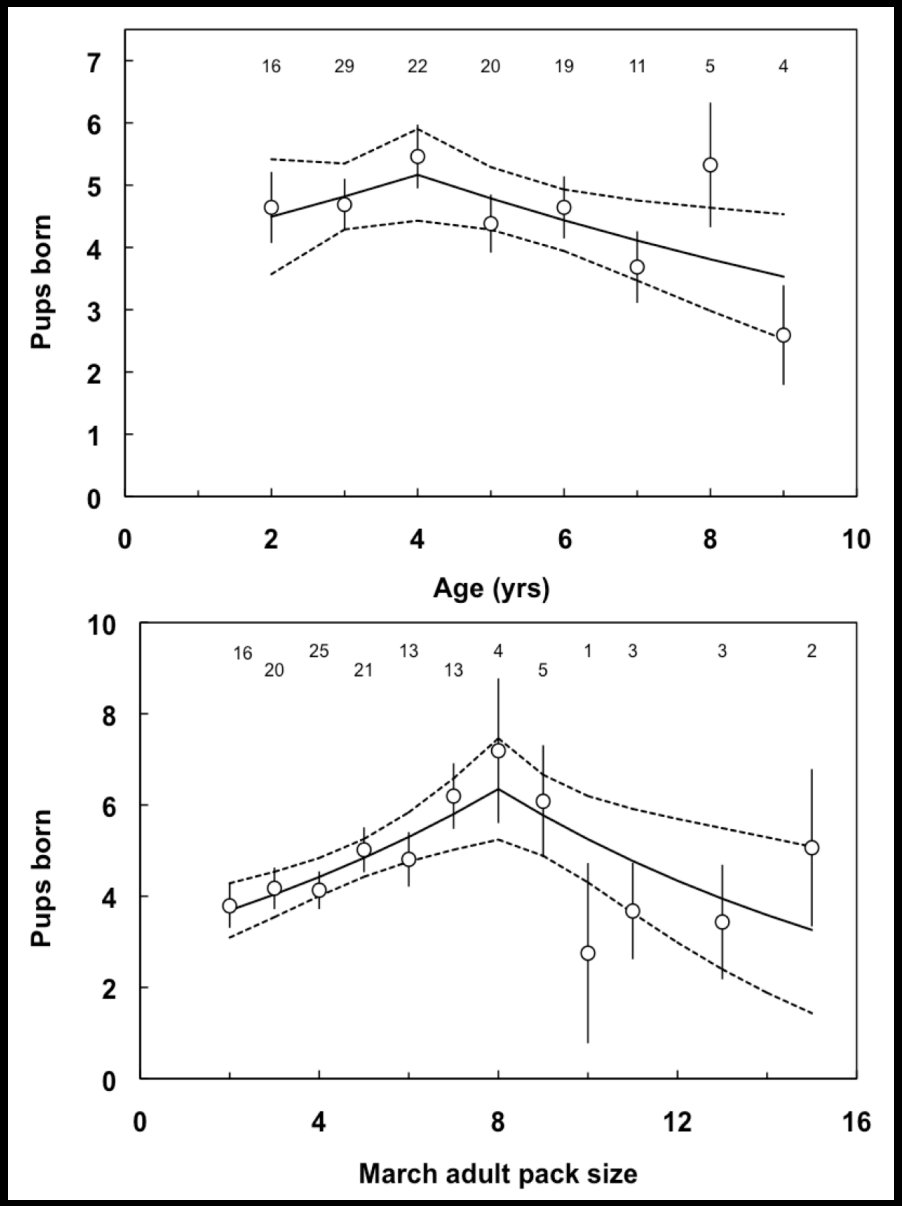
Relationship between ungulate biomass index and wolf density
Adapted from Keith 1983, Fuller 1989, and Fuller et al. 2003

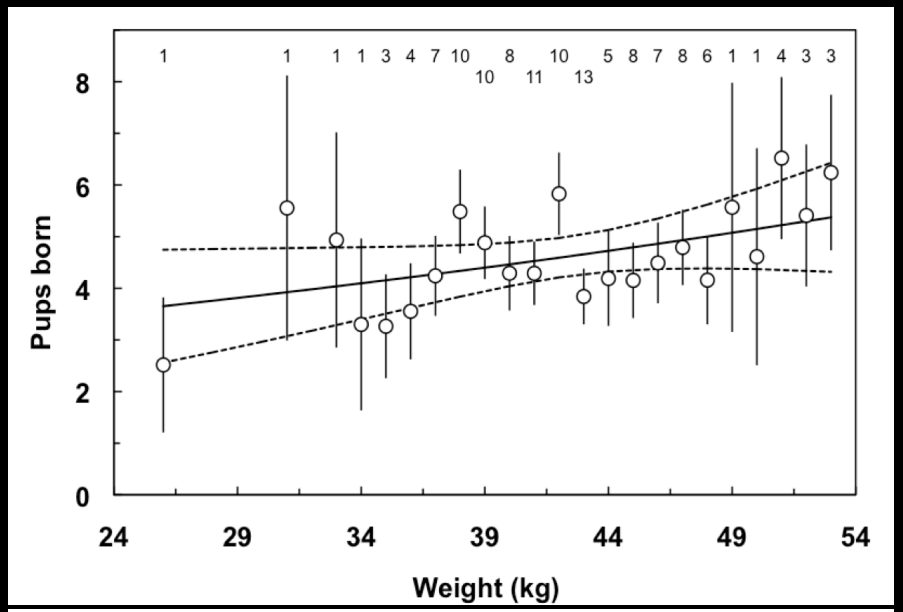


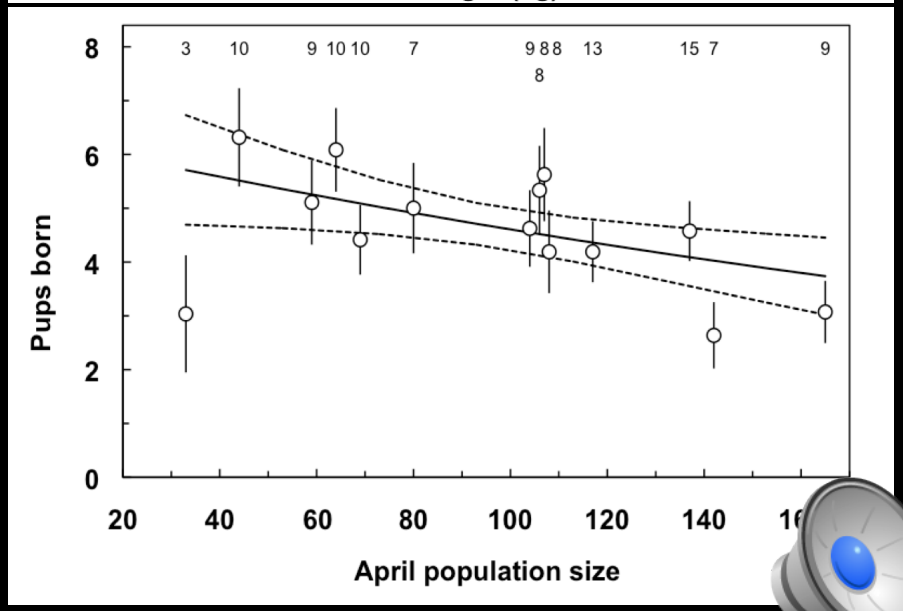
Elk & Bison Biomass Index with Migration & Sightibility Calculated in Relation to Wolf Density



Individual-, group-, and population-level effects on females' annual litter size at birth

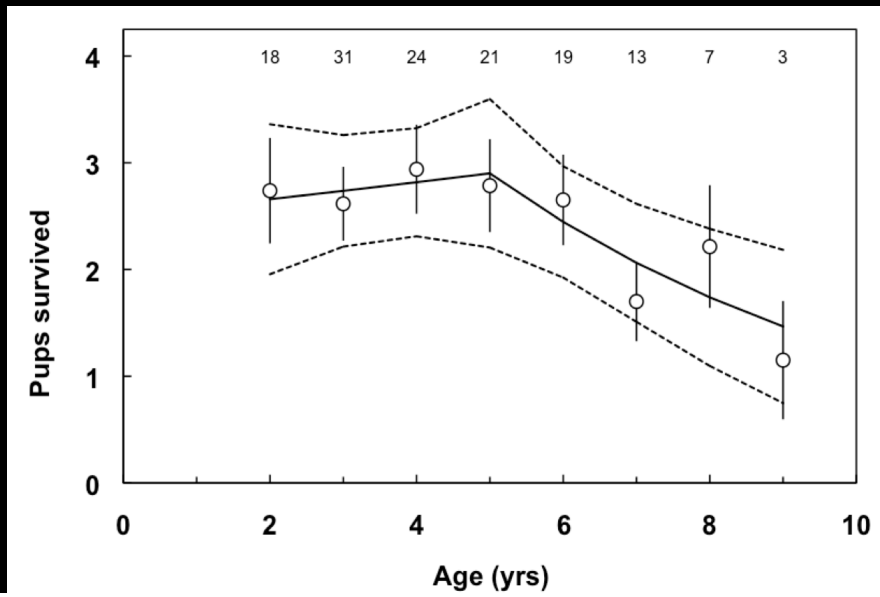


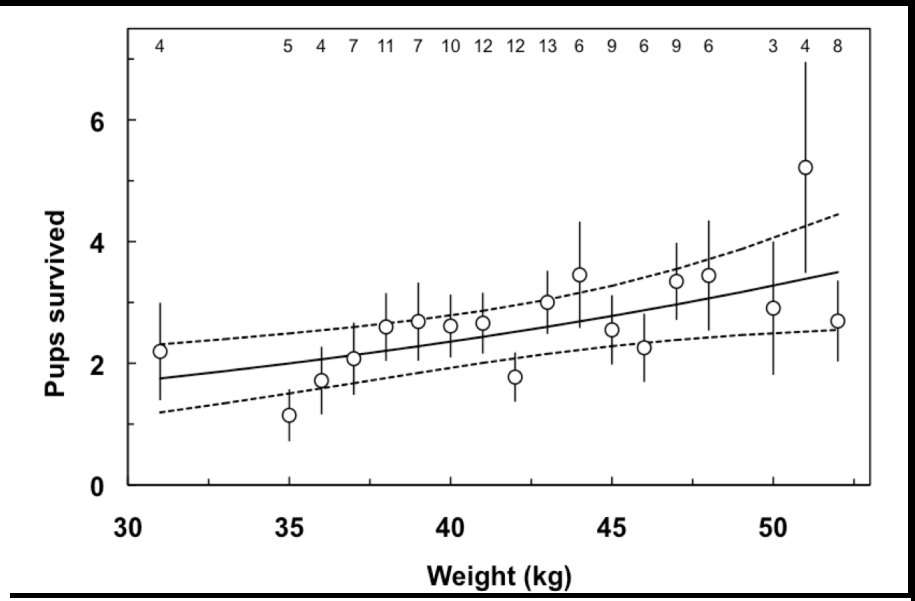


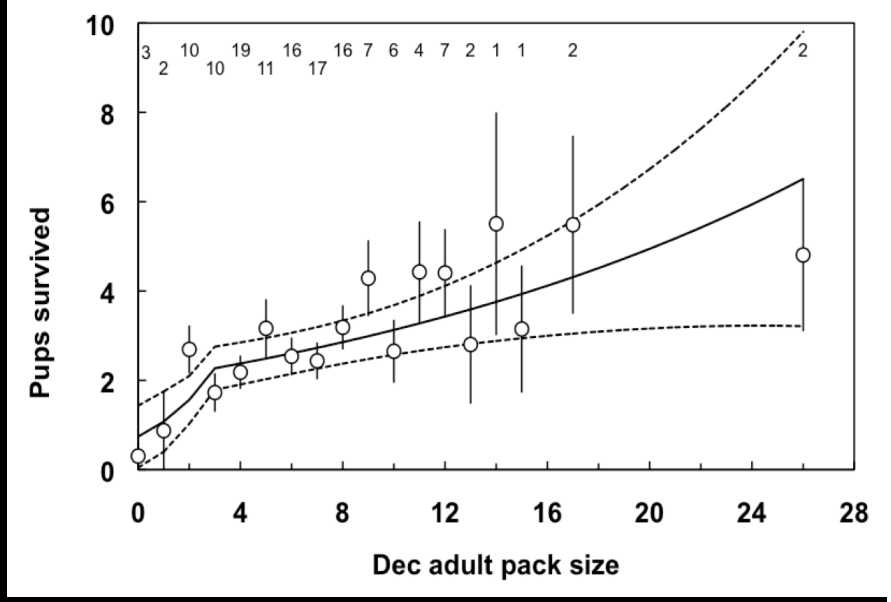


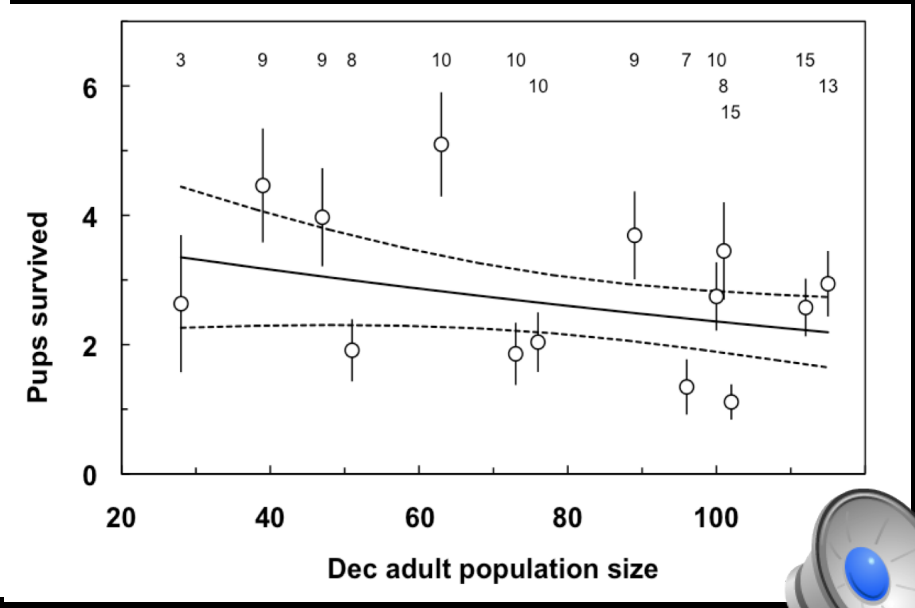
Stahler et al. in prep.

Individual-, group-, and population-level effects on females' annual litter survival



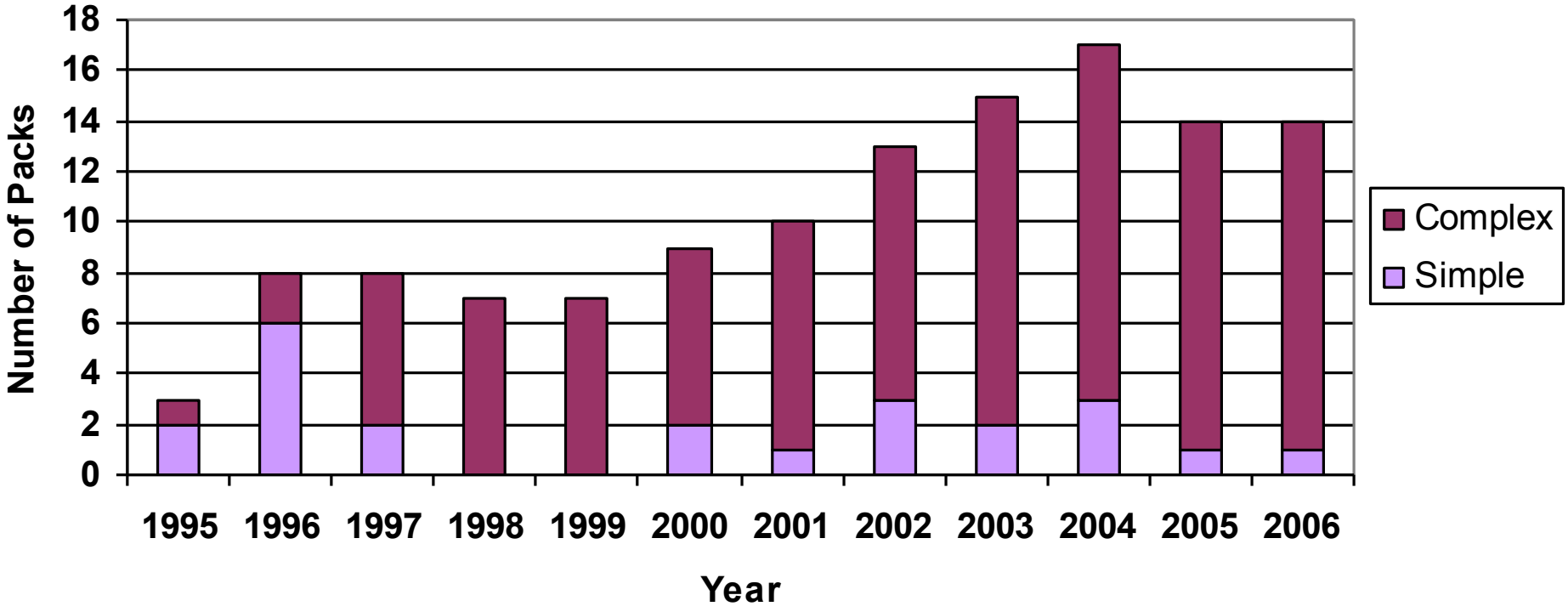


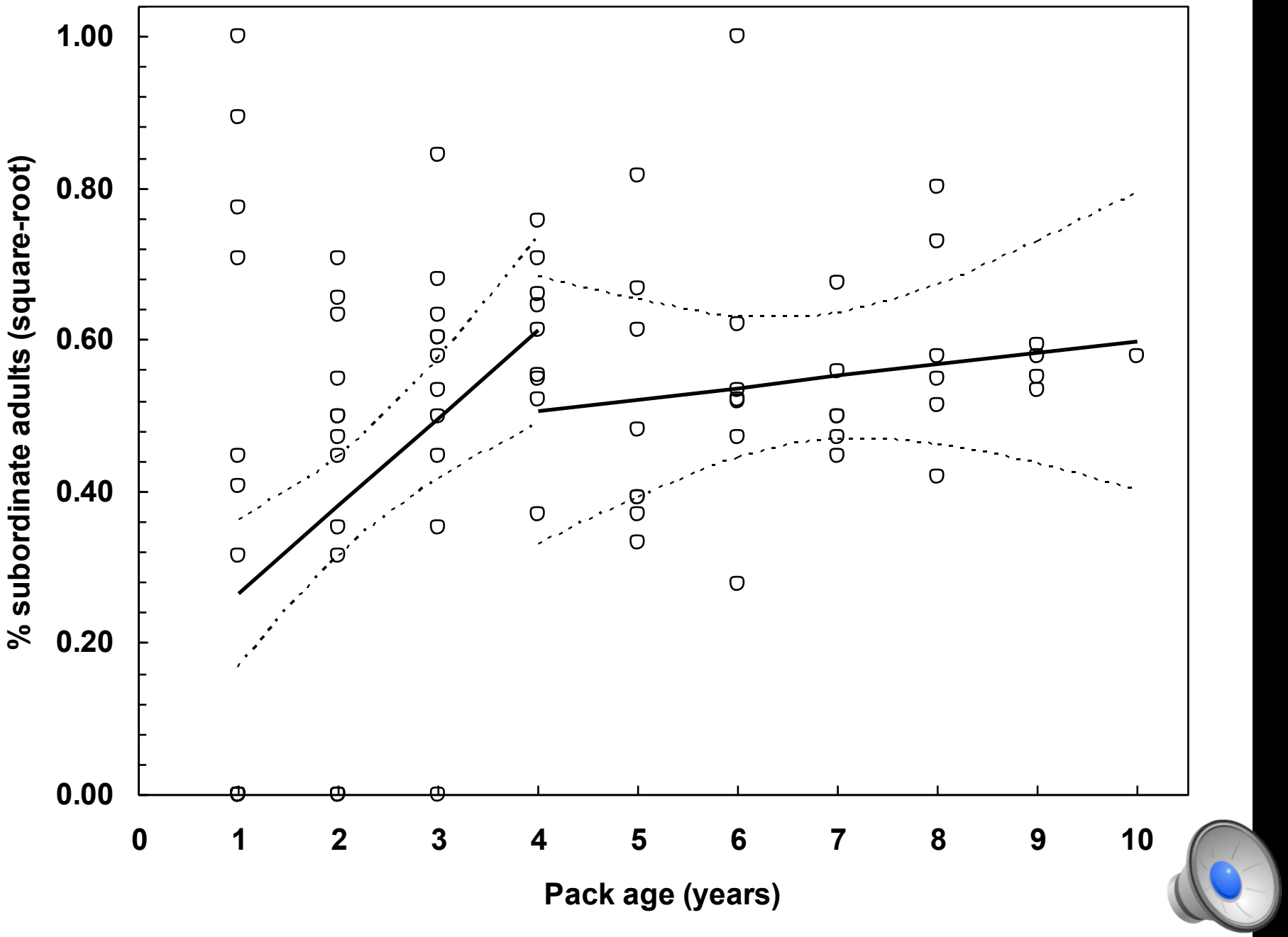


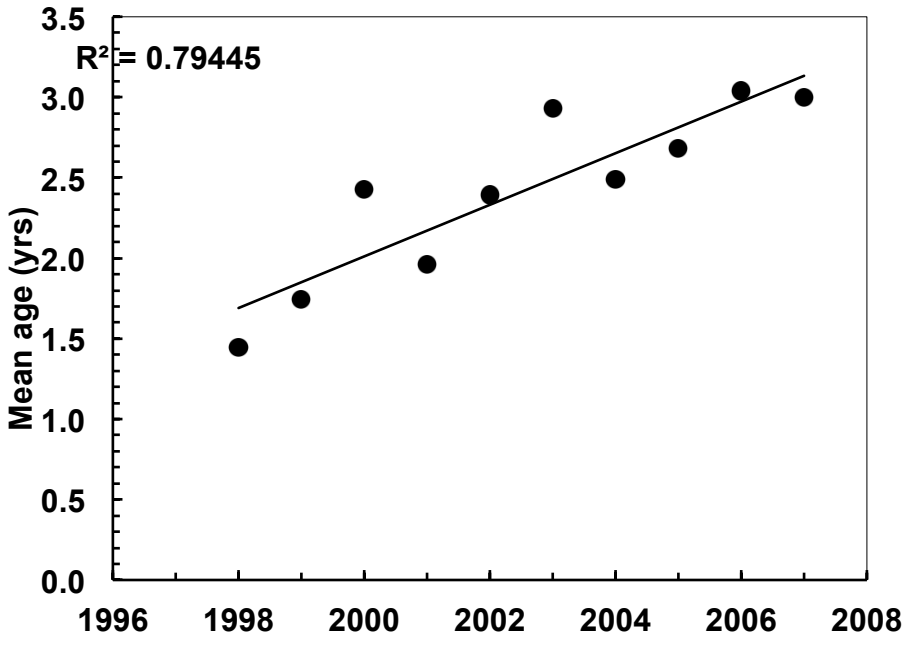


Stahler et al. in prep.

Simple vs Complex Pack Structure




1.00
0.80
0.60
0.40
0.20
0.00
% subordinate adults (square-root)
0
1
2
3
4
5
6
7
8
9
10
Pack age (years)


R^2 = 0.79445
Mean age (yrs)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1996
1998
2000
2002
2004
2006
2008

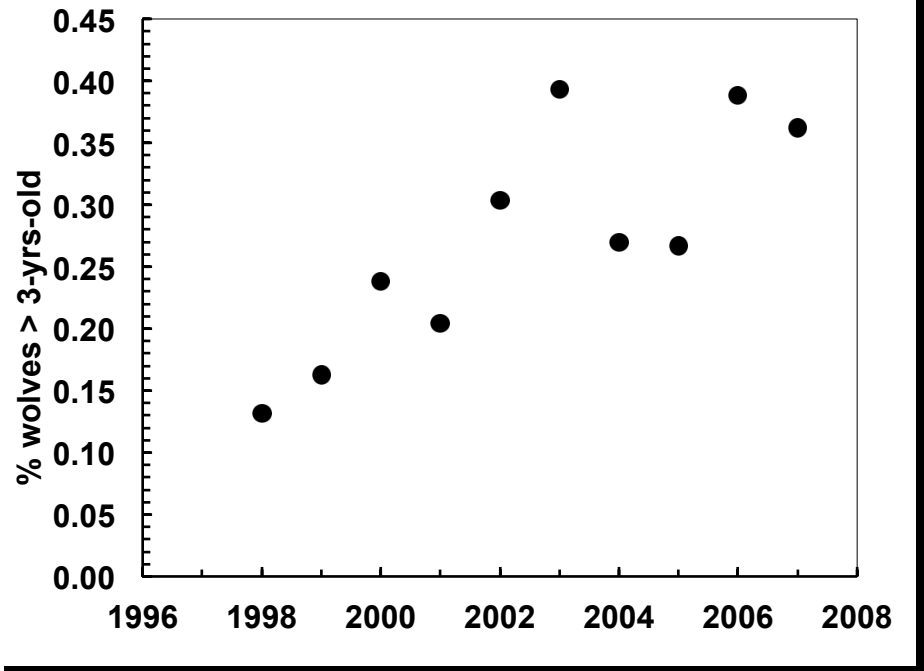
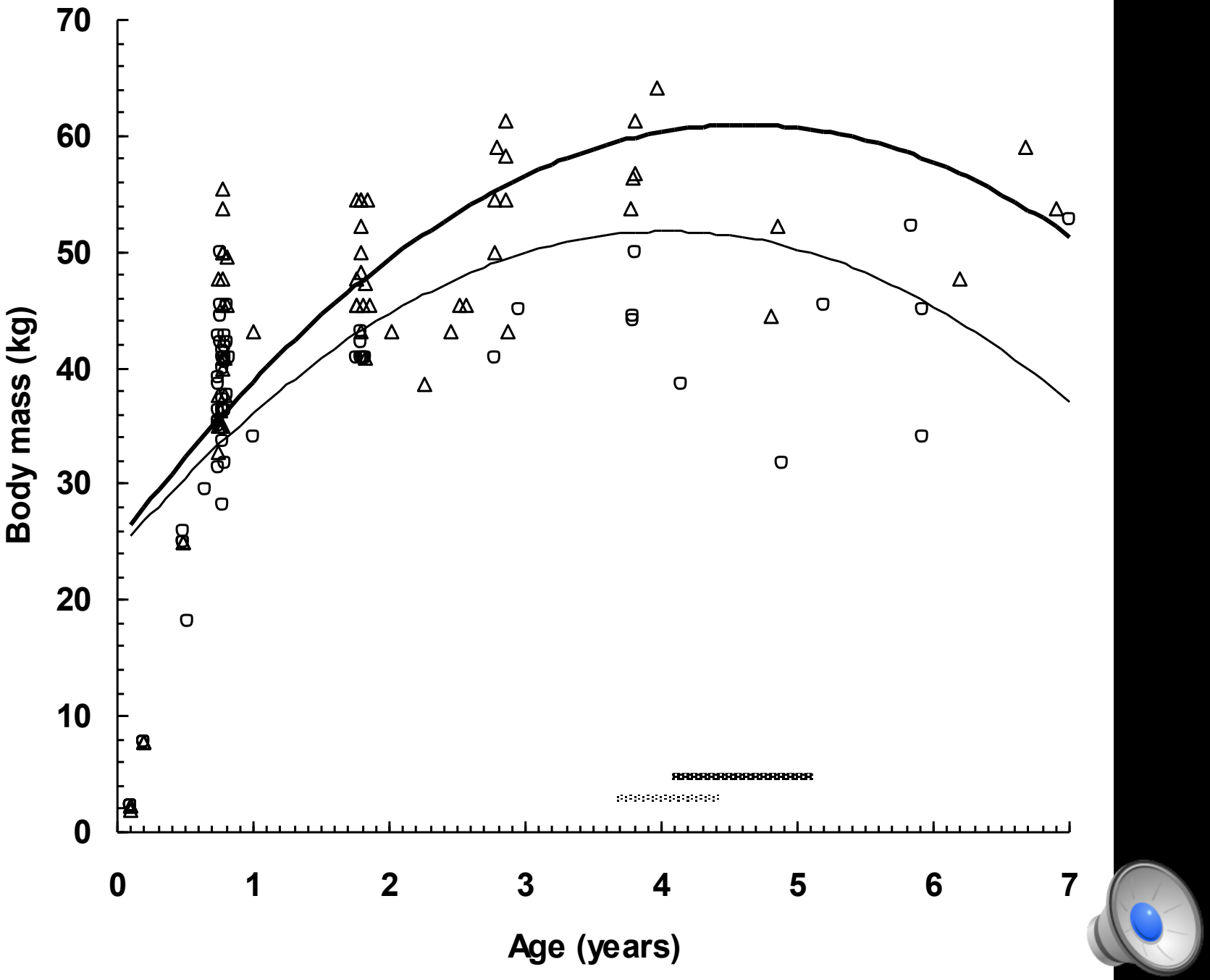
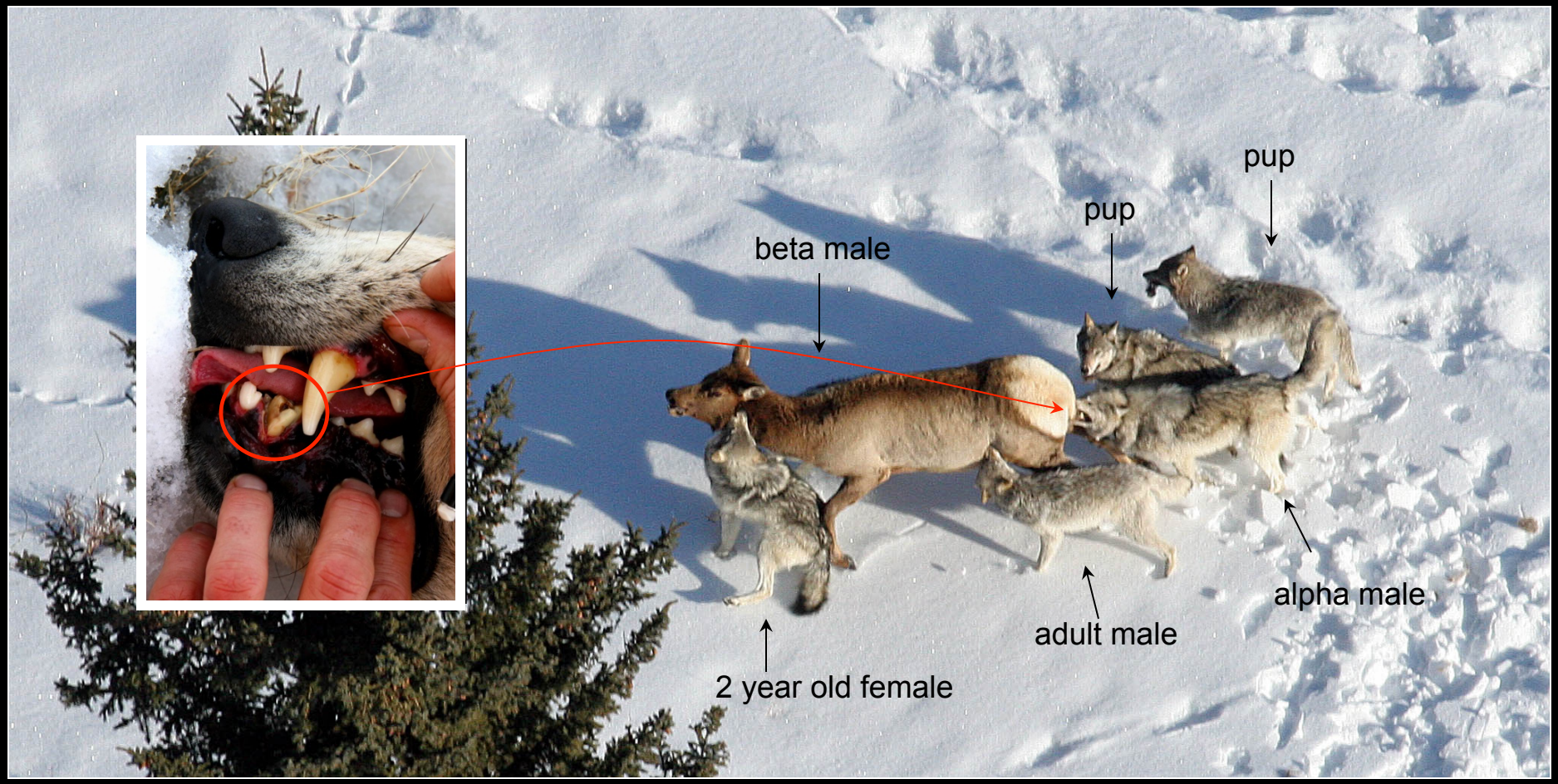

% wolves > 3-yrs-old
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1996
1998
2000
2002
2004
2006
2008

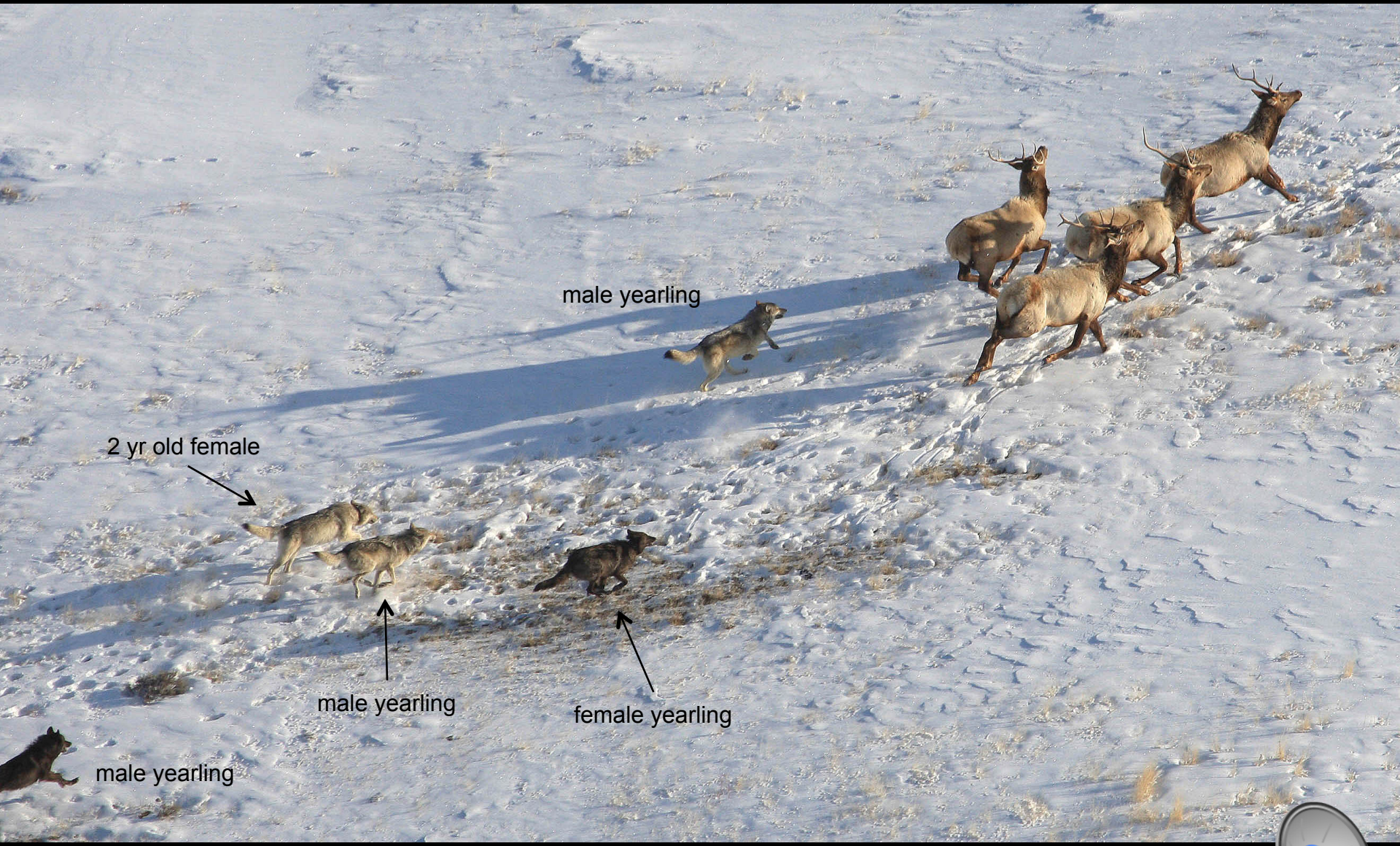
Photo: mark miller


70
60
50
40
30
20
10
0
Body mass (kg)
0
1
2
3
4
5
6
7
Age (years)

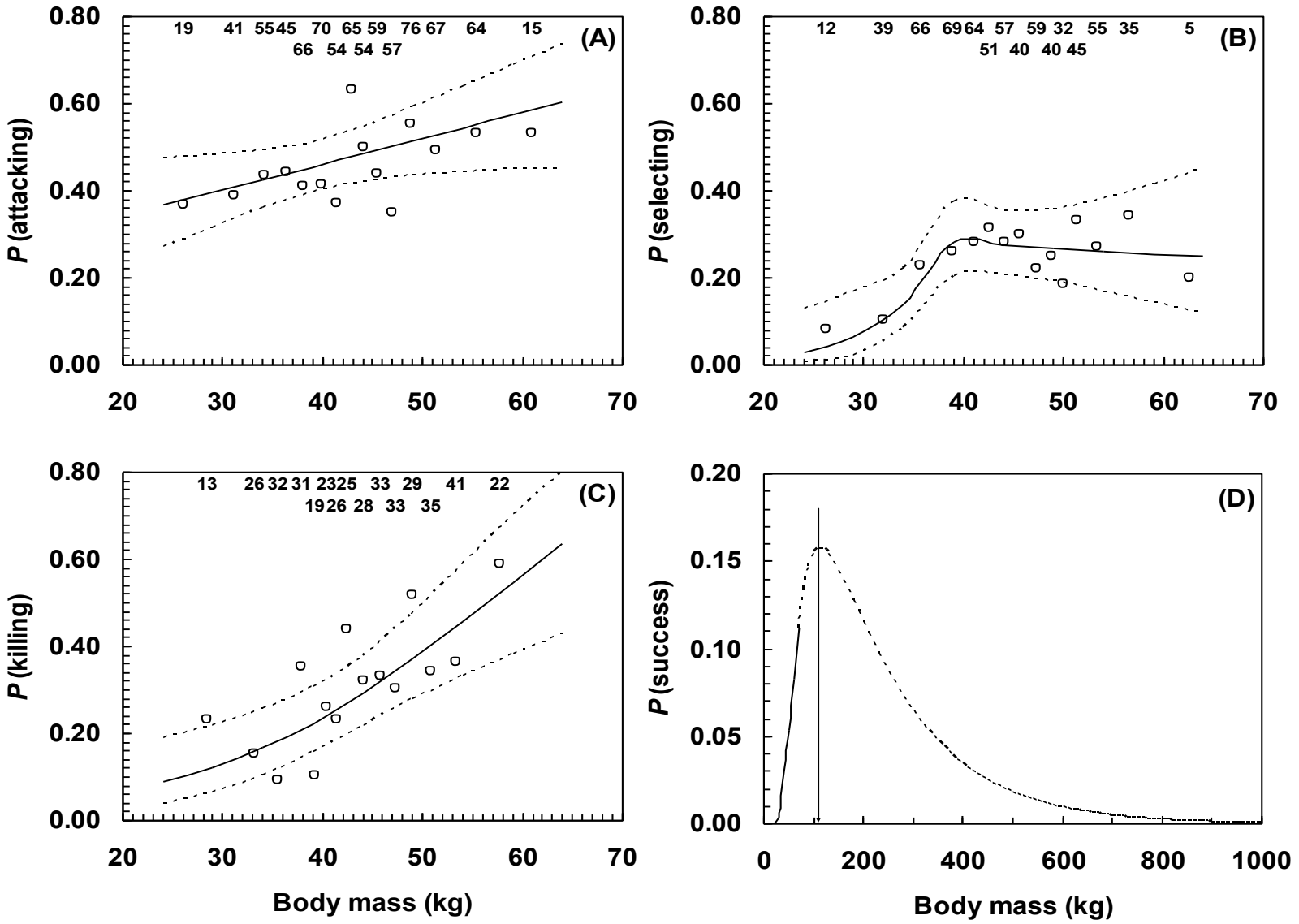

2 year old female
pup
pup
adult male
beta male


pup
pup
beta male
alpha male
adult male
2 year old female

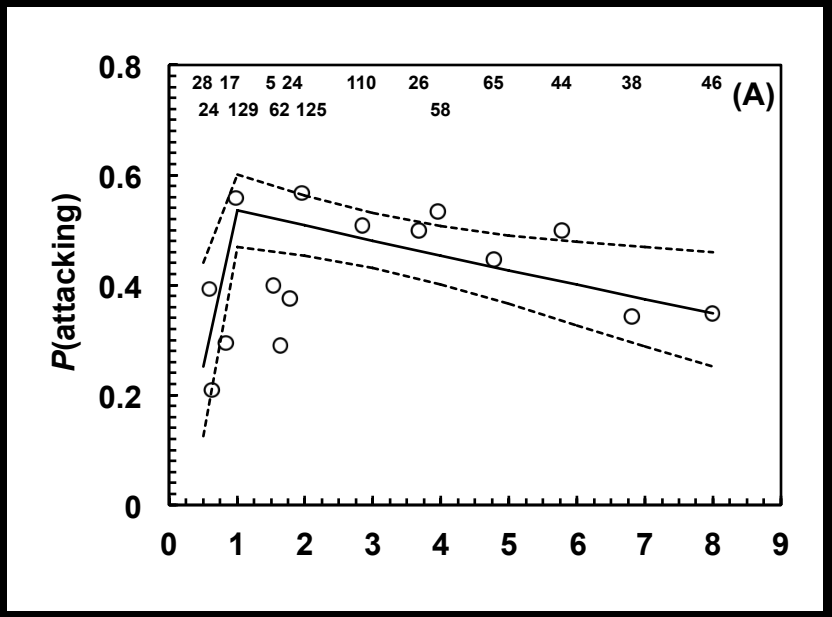

female yearling
male yearling
male yearling
8 year old male

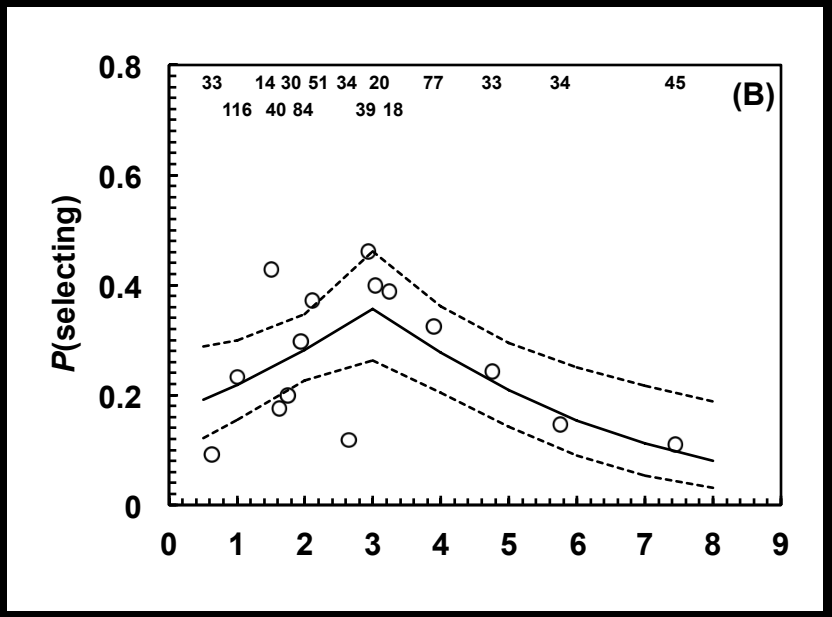

male yearling
2 yr old female
male yearling
female yearling
male yearling

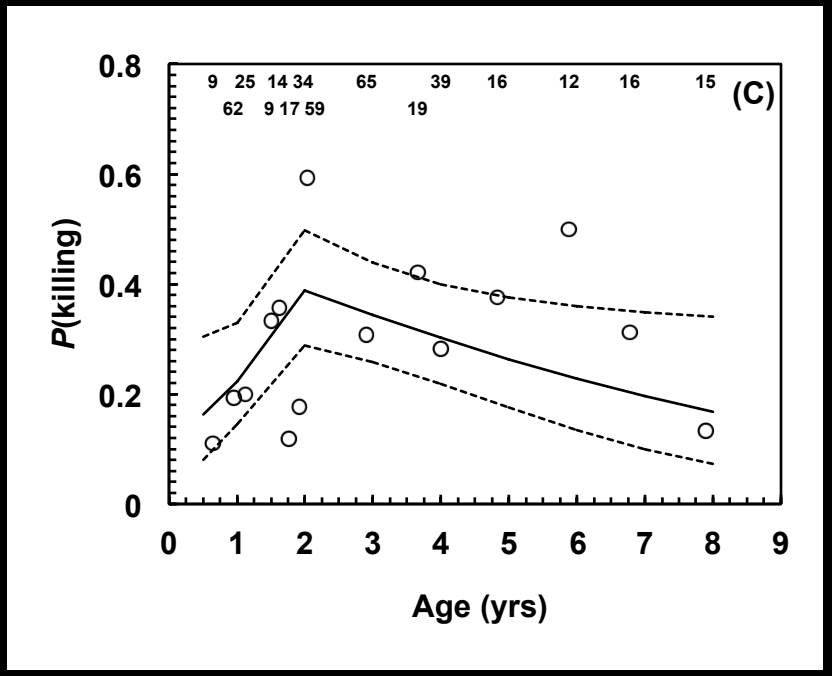

male yearling
female yearling
male yearling
male yearling
2 yr old female
8 year old male

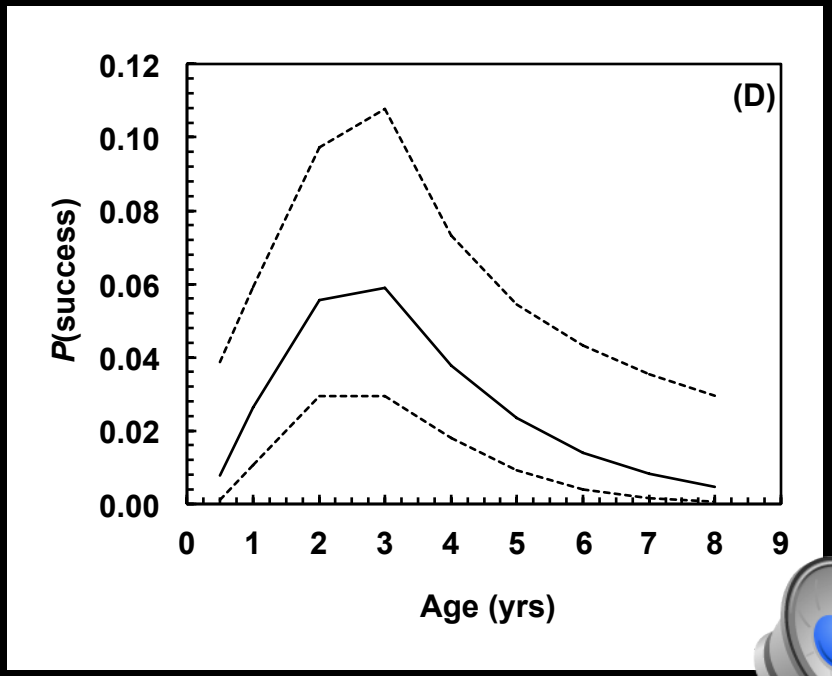


MacNulty et al. 2009 *Journal of Animal Ecology*

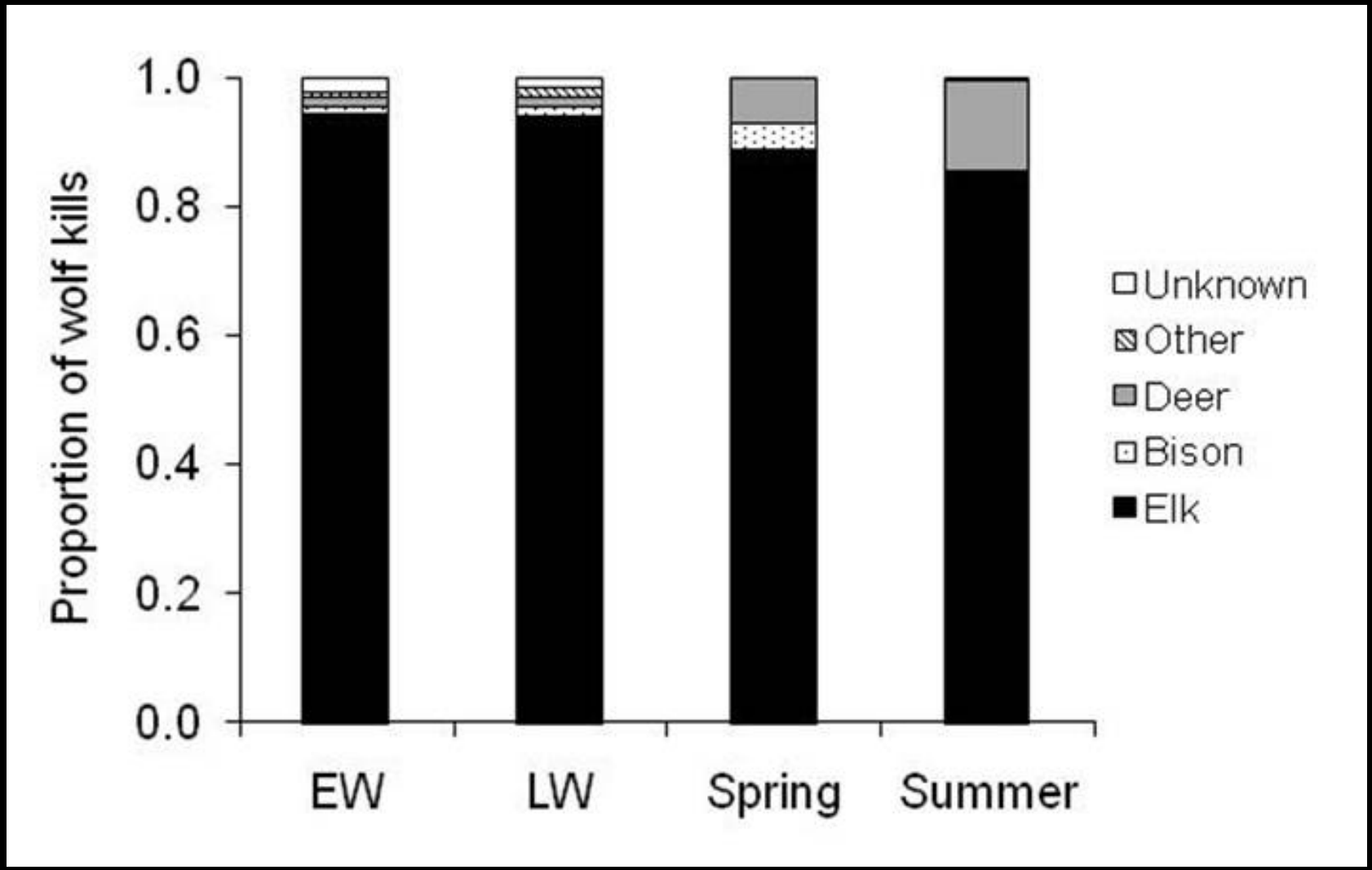


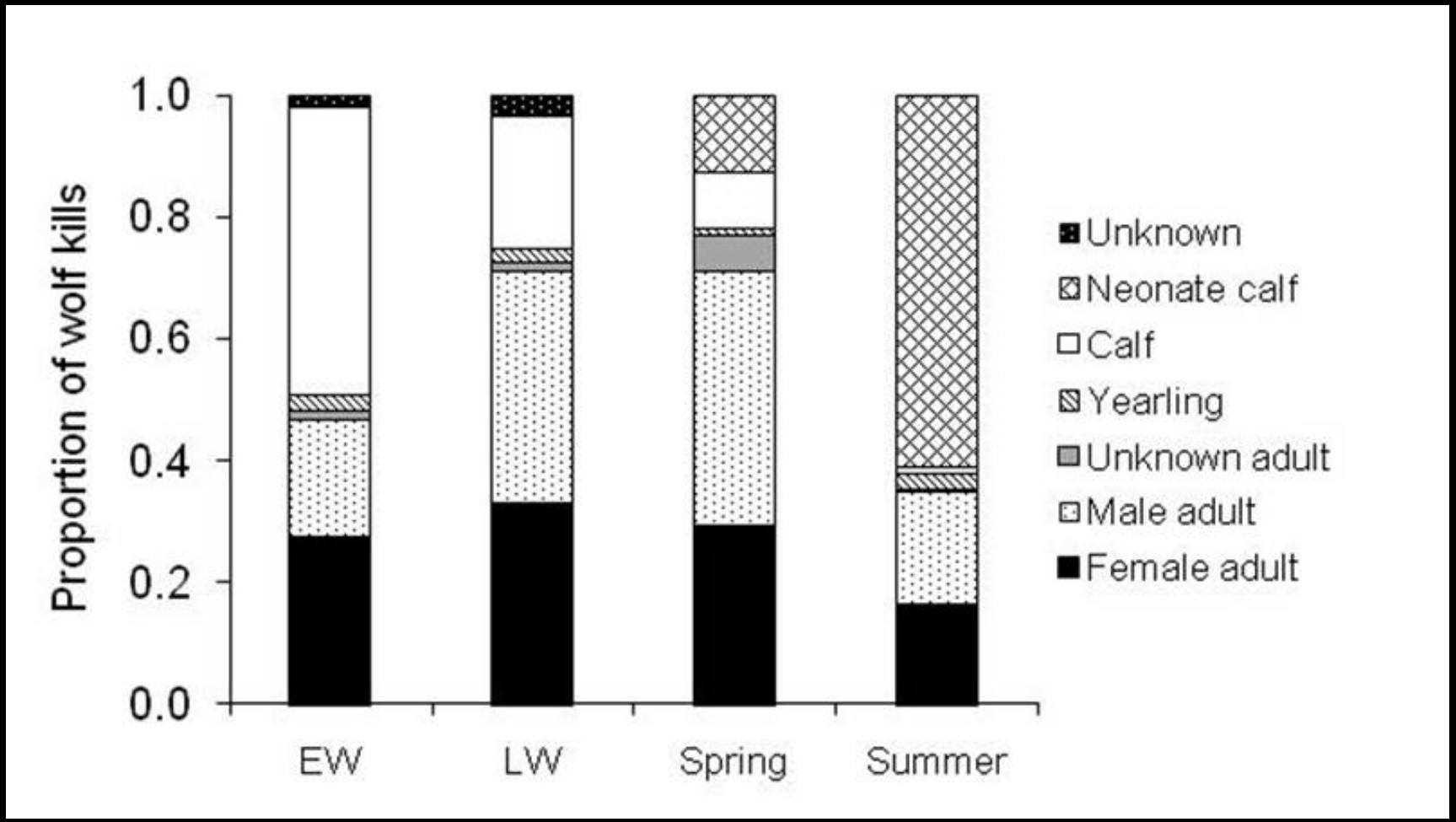


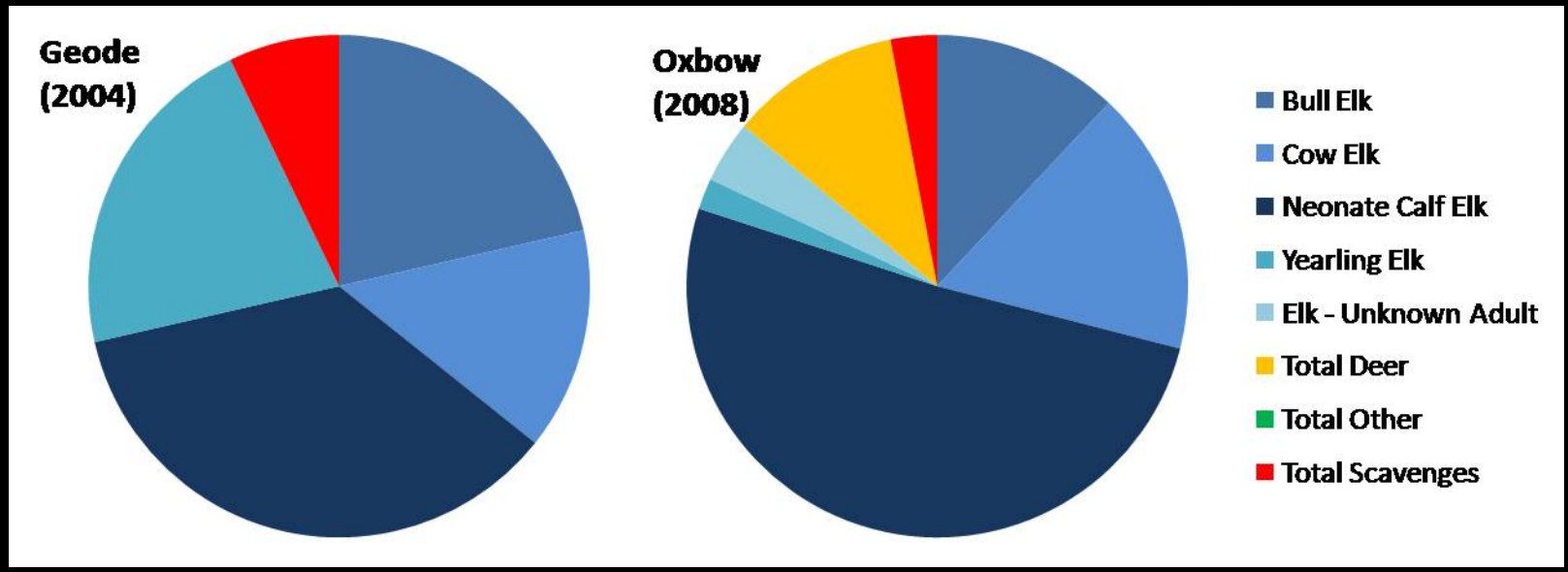


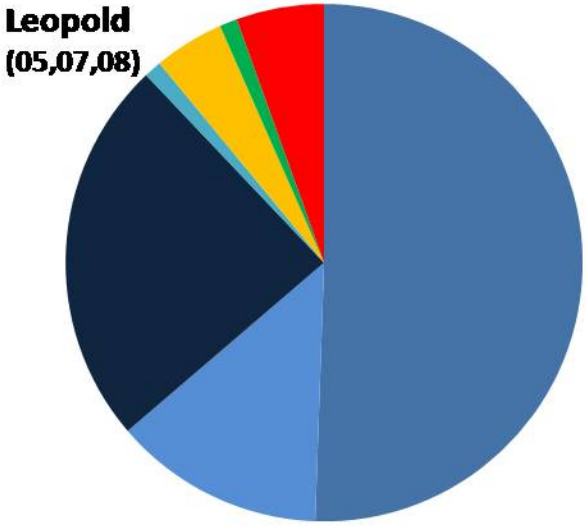


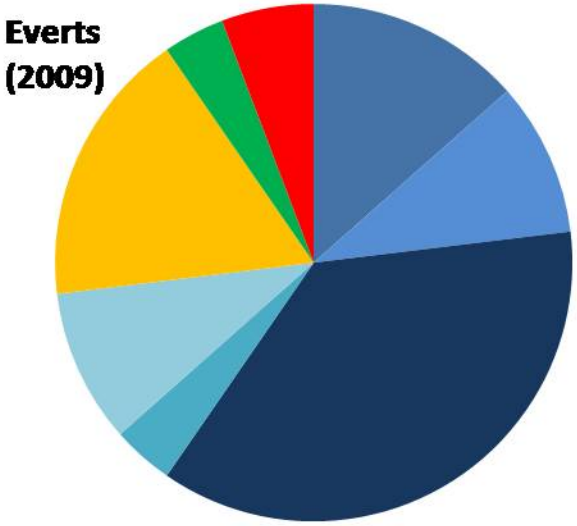
MacNulty et al. 2009 *Ecology Letters*

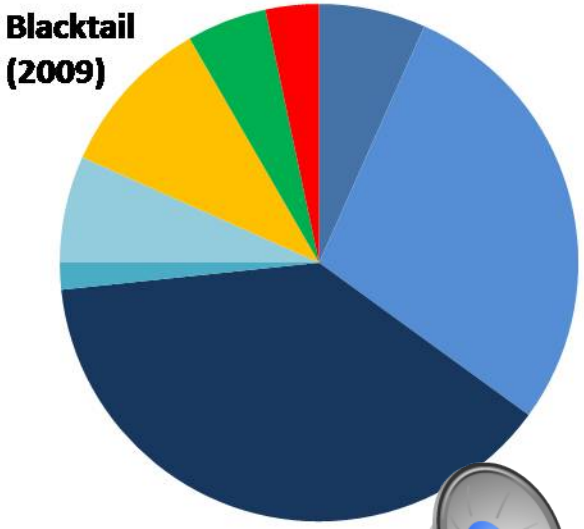

Proportion of wolf kills
1.0
0.8
0.6
0.4
0.2
0.0
EW
LW
Spring
Summer
Unknown
Other
Deer
Bison
Elk


Proportion of wolf kills
1.0
0.8
0.6
0.4
0.2
0.0
EW
LW
Spring
Summer
Unknown
Neonate calf
Calf
Yearling
Unknown adult
Male adult
Female adult

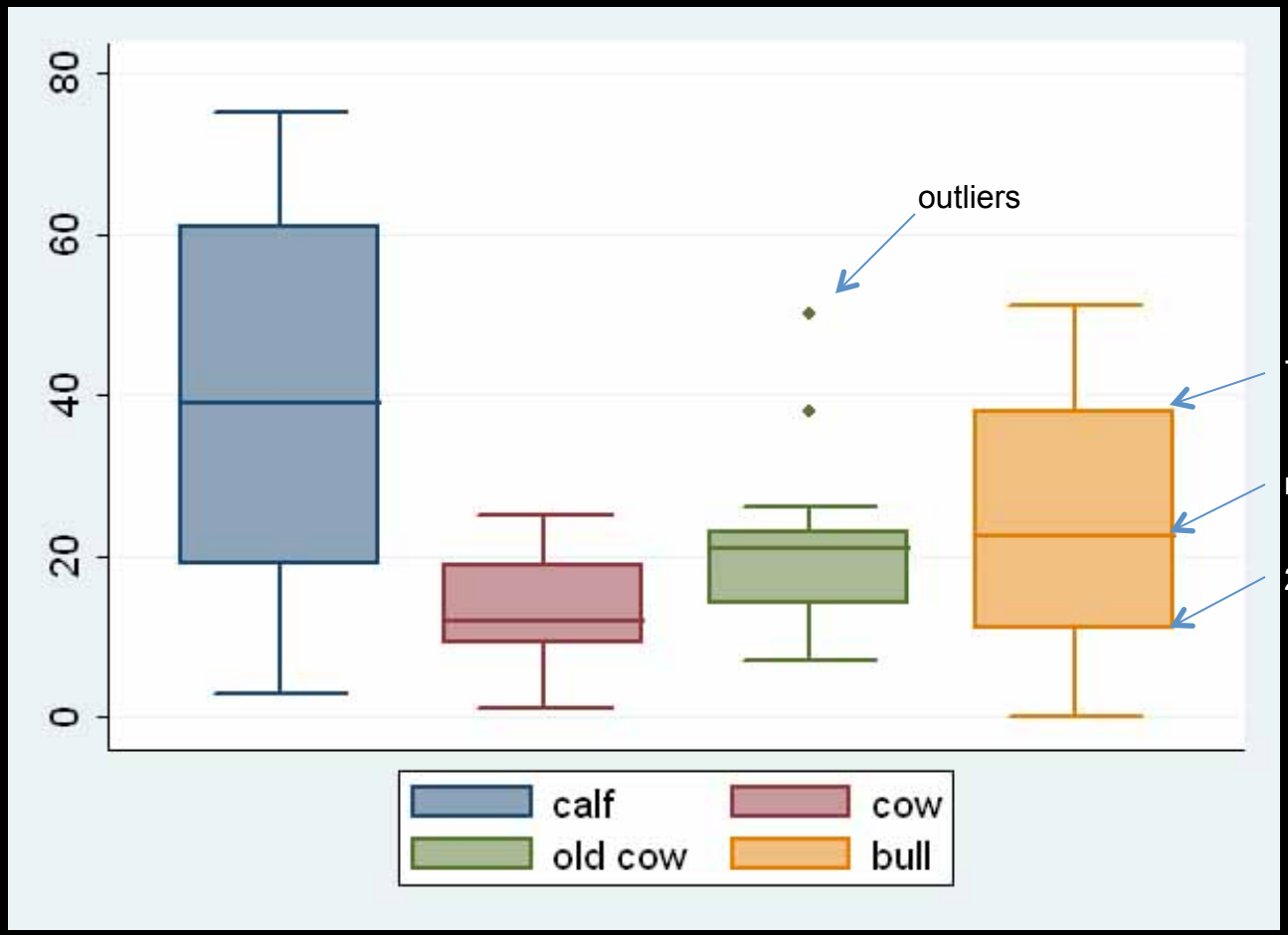

Geode
(2004)
Oxbow
(2008)
Bull Elk
Cow Elk
Neonate Calf Elk
Yearling Elk
Elk - Unknown Adult
Total Deer
Total Other
Total Scavenges


Leopold
(05,07,08)


Everts
(2009)


Blacktail
(2009)

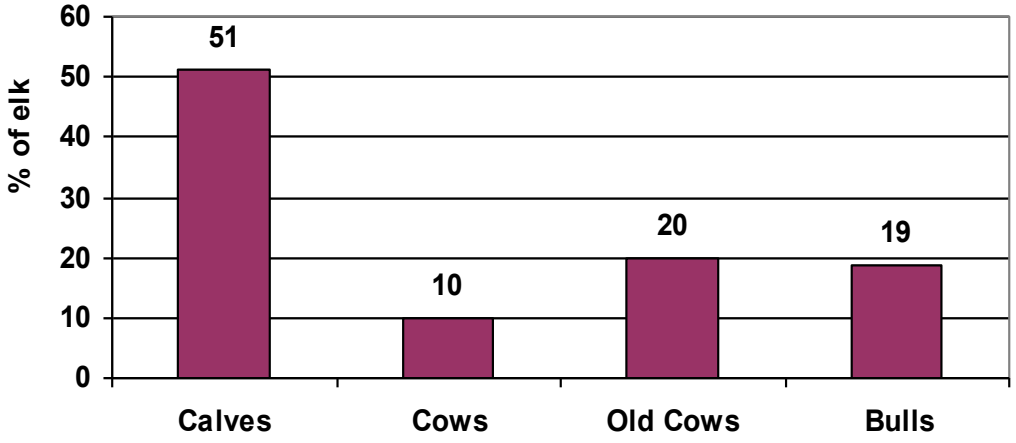
# Northern Range winter wolf-killed elk
# 1995-2008
N= 1380




DURALL
EAGLE
2
3
4

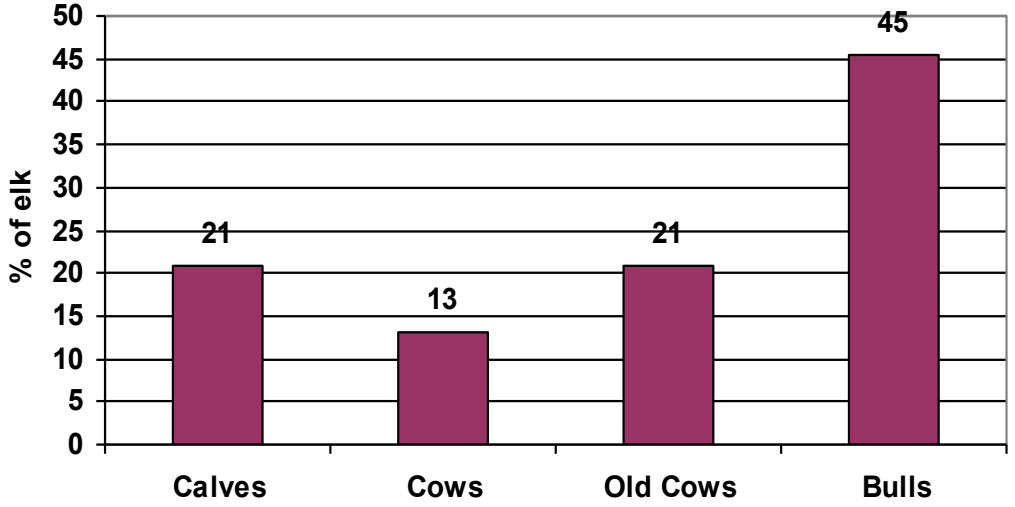
Wolf-Killed Elk on Yellowstone's Northern Range Nov-Dec's of 1995 - 2003

N = 277

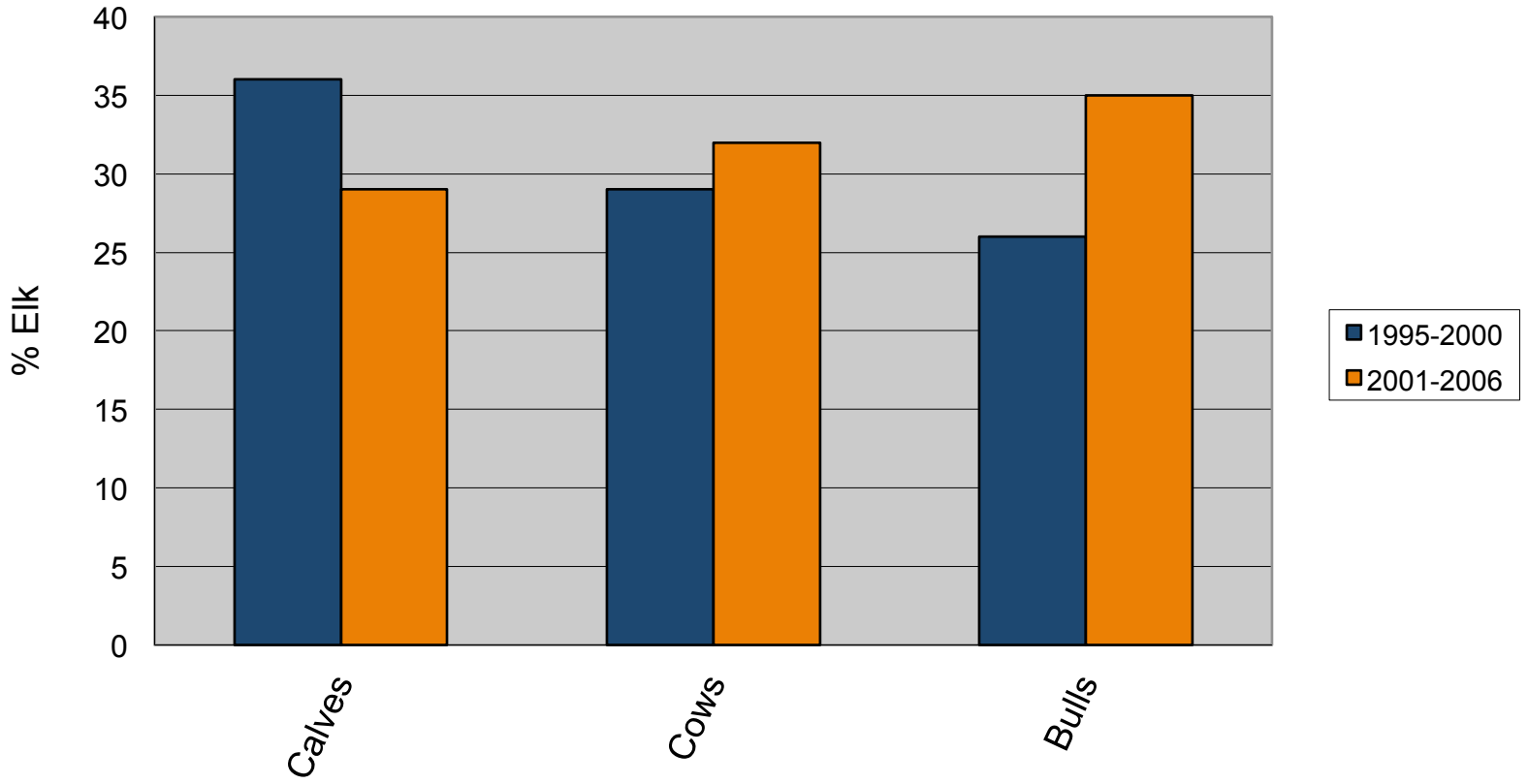


Wolf-Killed Elk in Yellowstone's Northern Range, Nov-Dec 2004 & 2005

N = 77



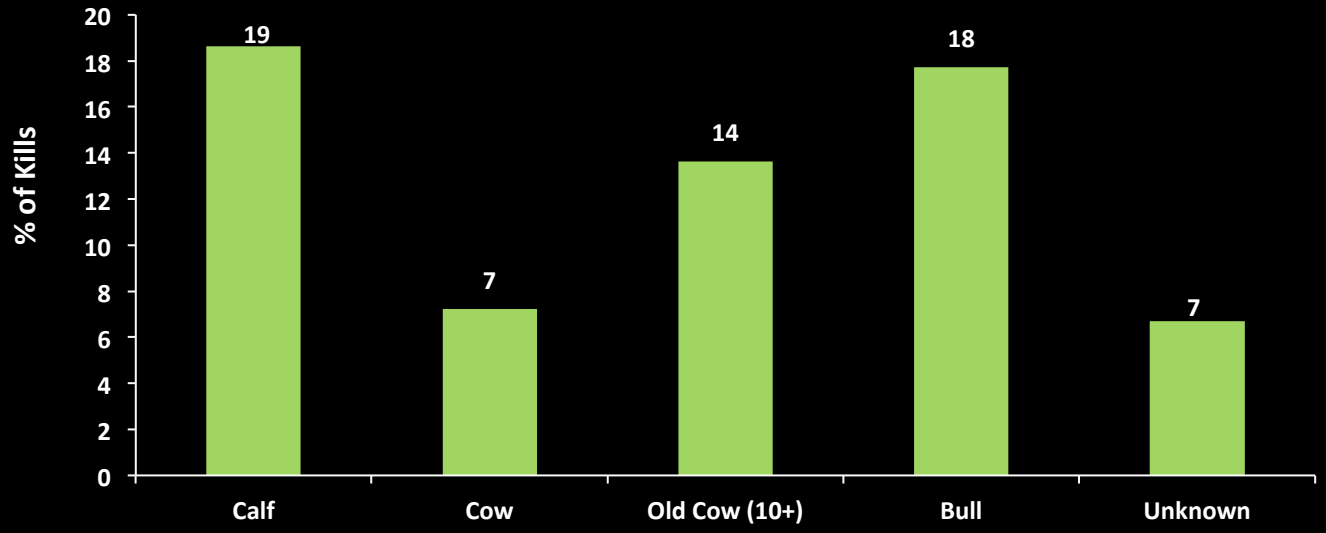
1995-2000 & 2001-2006 Prey Selection Comparison



$X^2 = 14.97$ df = 3 P = 0.0018

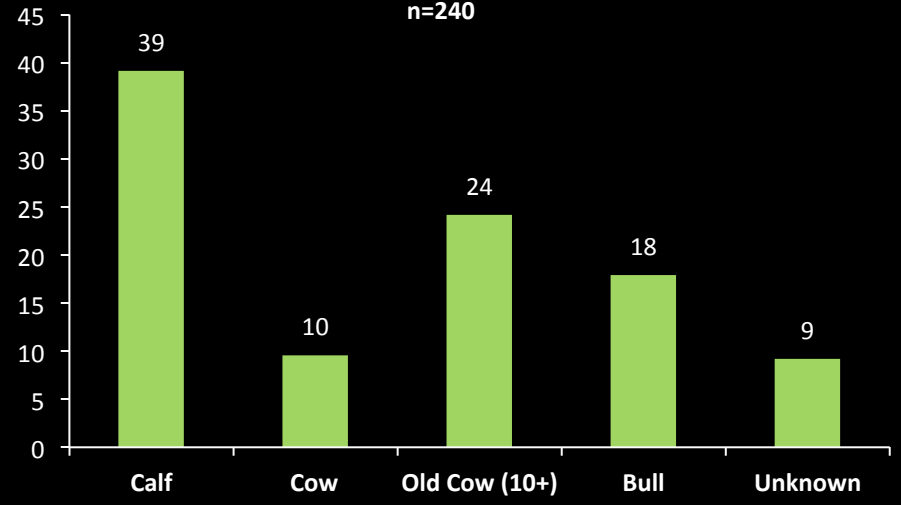
1995-2008 Winter Wolf-Killed Elk in YNP Northern Range

[November 1 - March 31]
n=1739



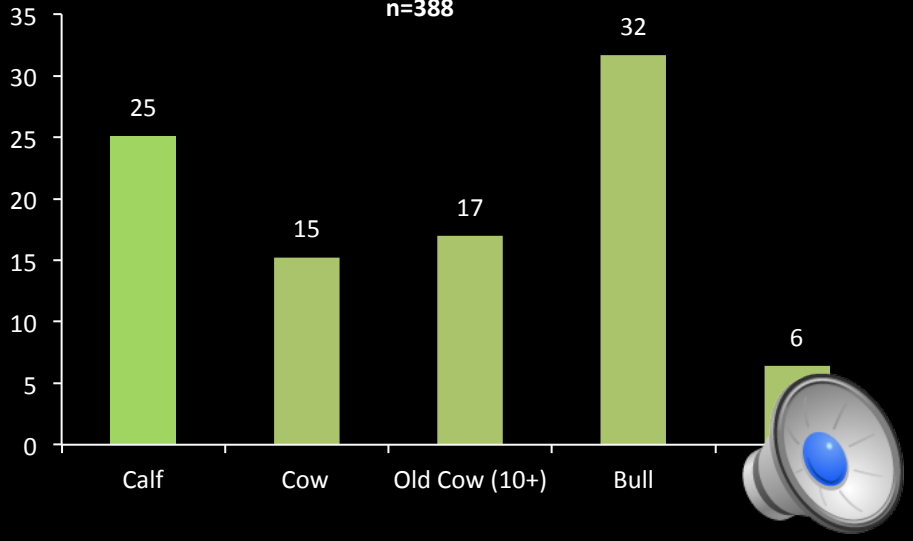
1995-1998

[November 1- March 31]
n=240



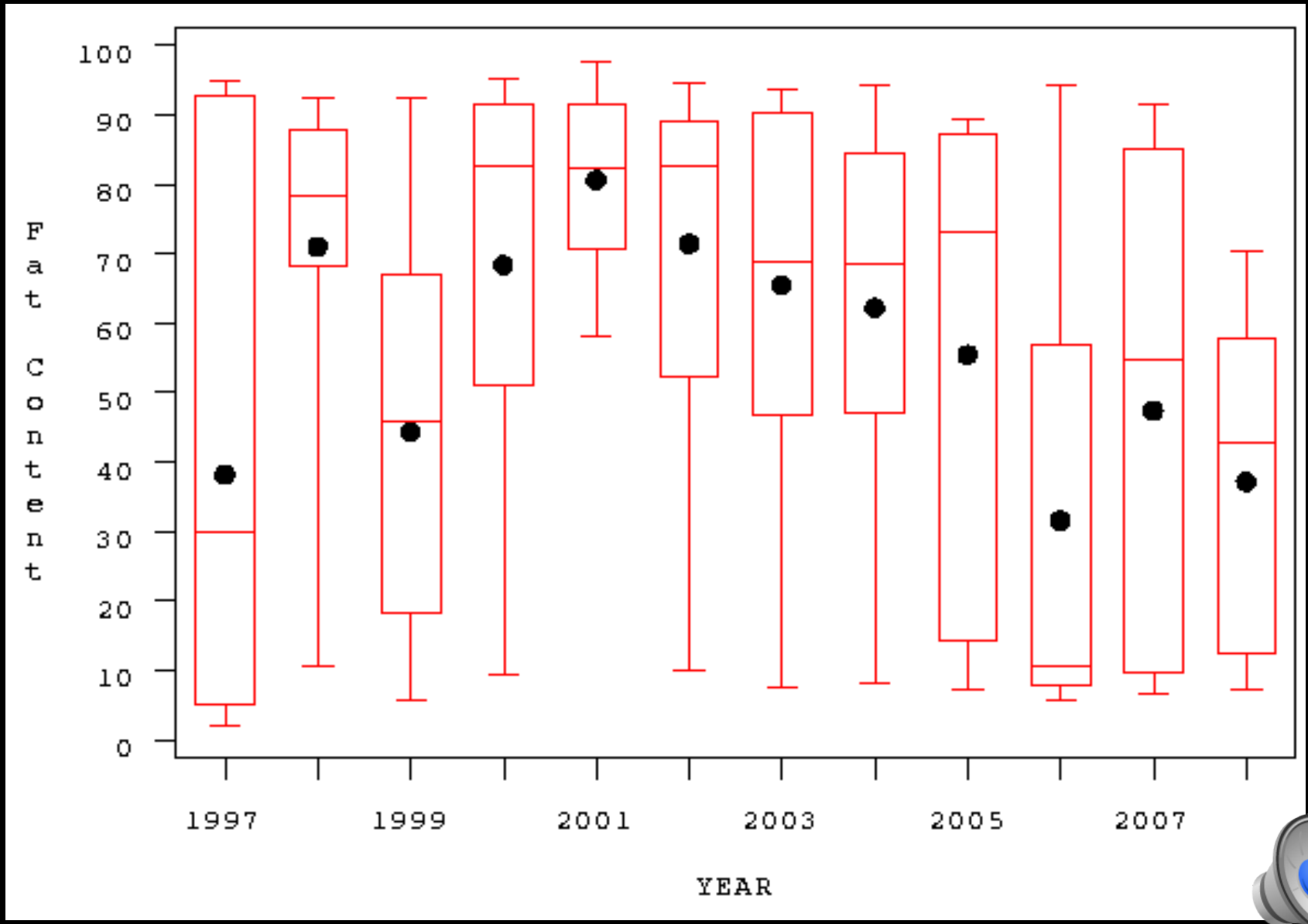
2006-2008

[November 1- March 31]
n=388

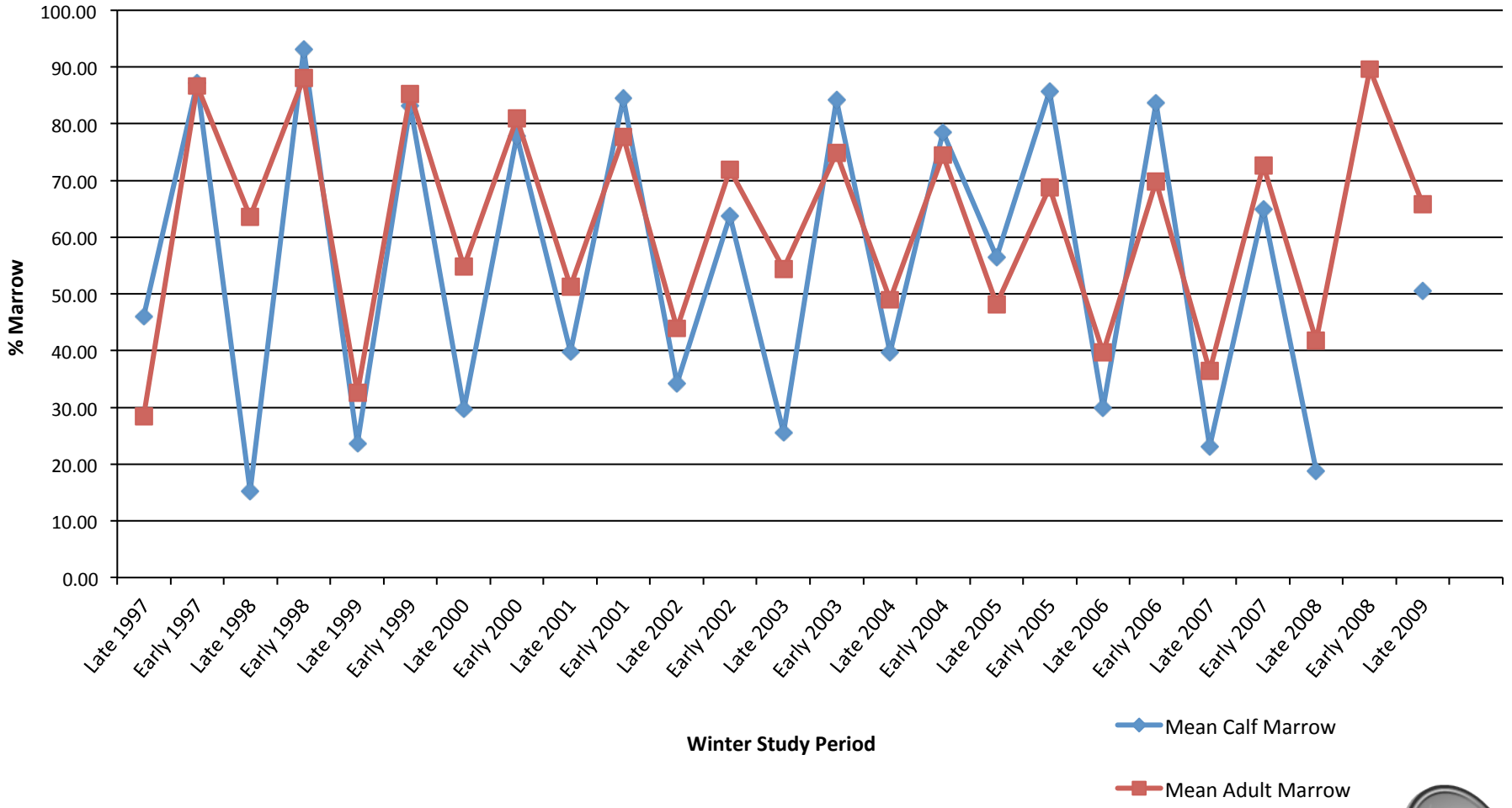


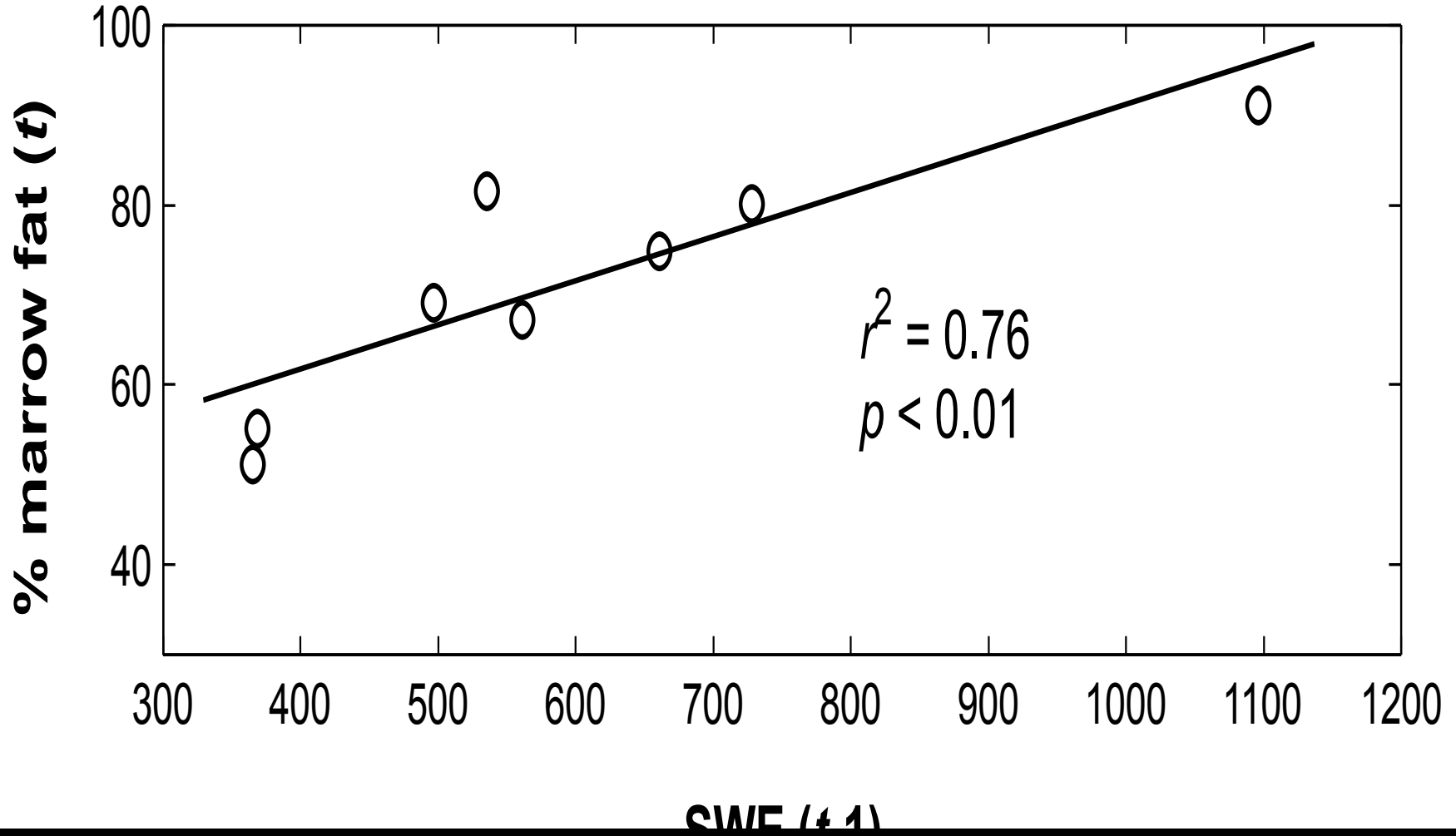
wolf predation → elk condition (bull elk) → summer forage (quality & quantity) → climate change?

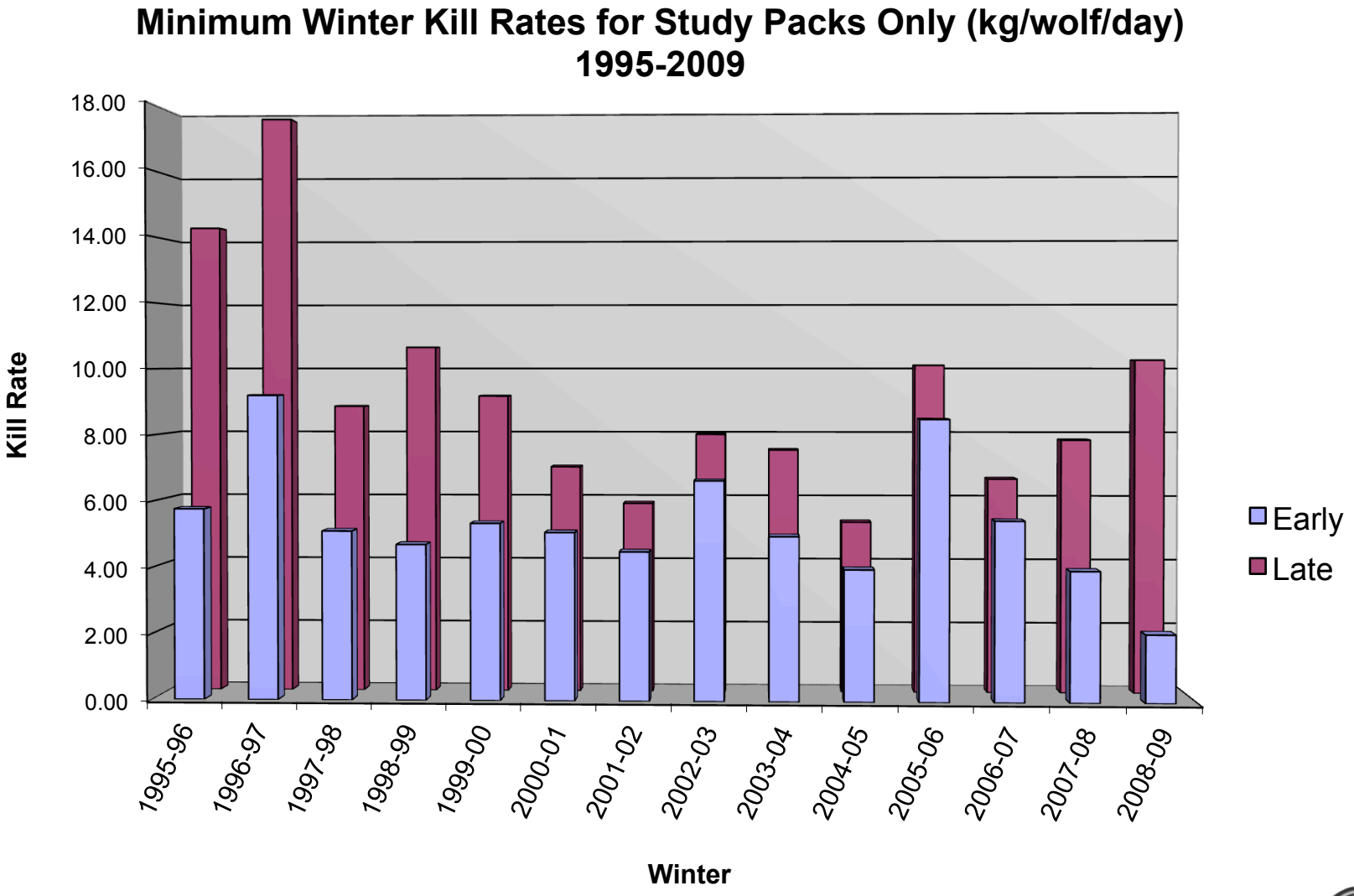
Yearly Distribution of Bone Marrow Fat
Nov - March



Mean Bone Marrow % Fat for Wolf-Killed Northern Range Elk During Winter Study, 1997-2009

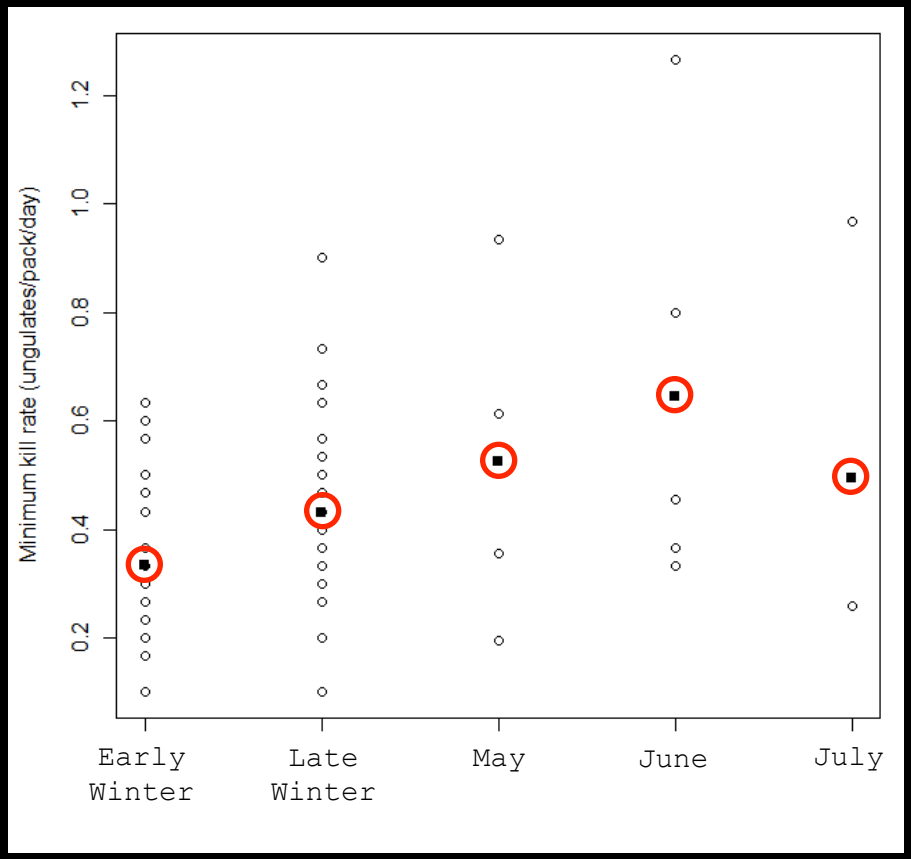



100
80
60
40
% marrow fat (t)
300
400
500
600
700
800
900
1000
1100
1200
r2 = 0.76
p < 0.01

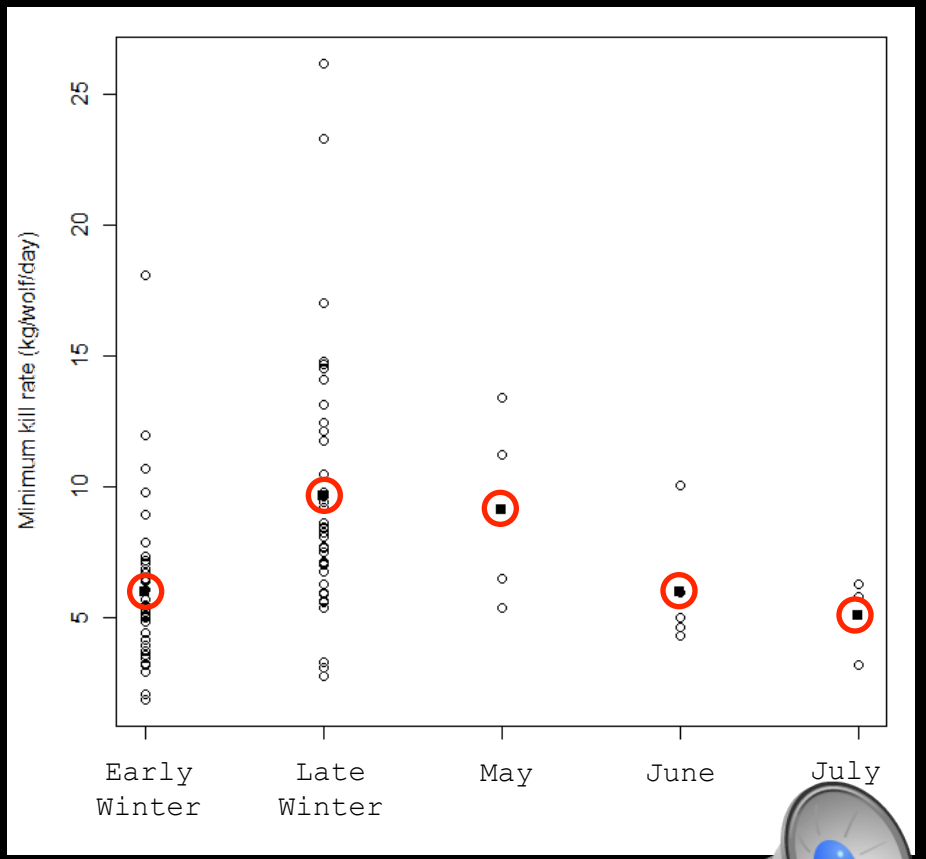

Minimum Winter Kill Rates for Study Packs Only (kg/wolf/day)
1995-2009
Kill Rate
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
Winter
Early
Late

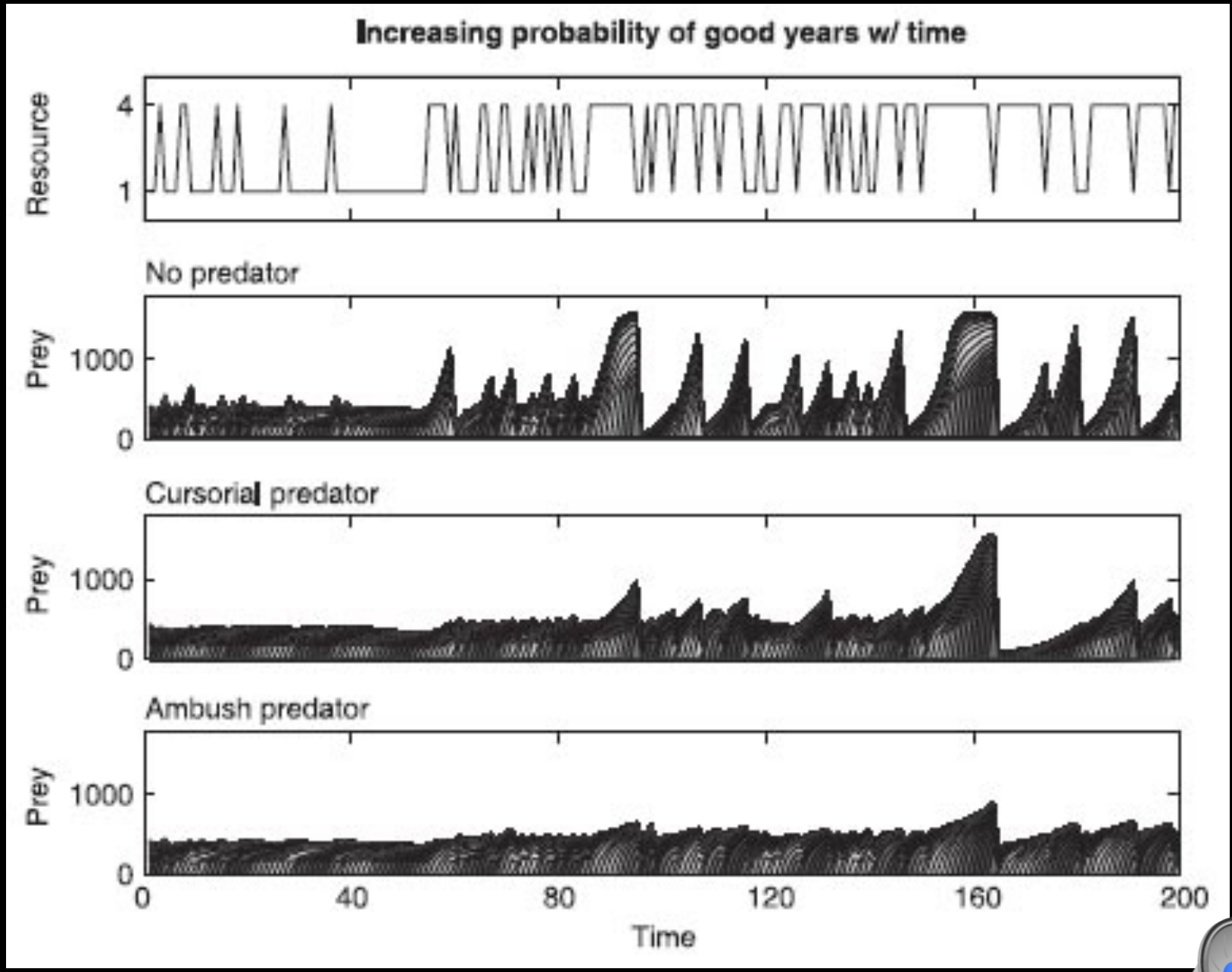
Seasonal comparison of minimum kill rates

Number of ungulates



Biomass of ungulates

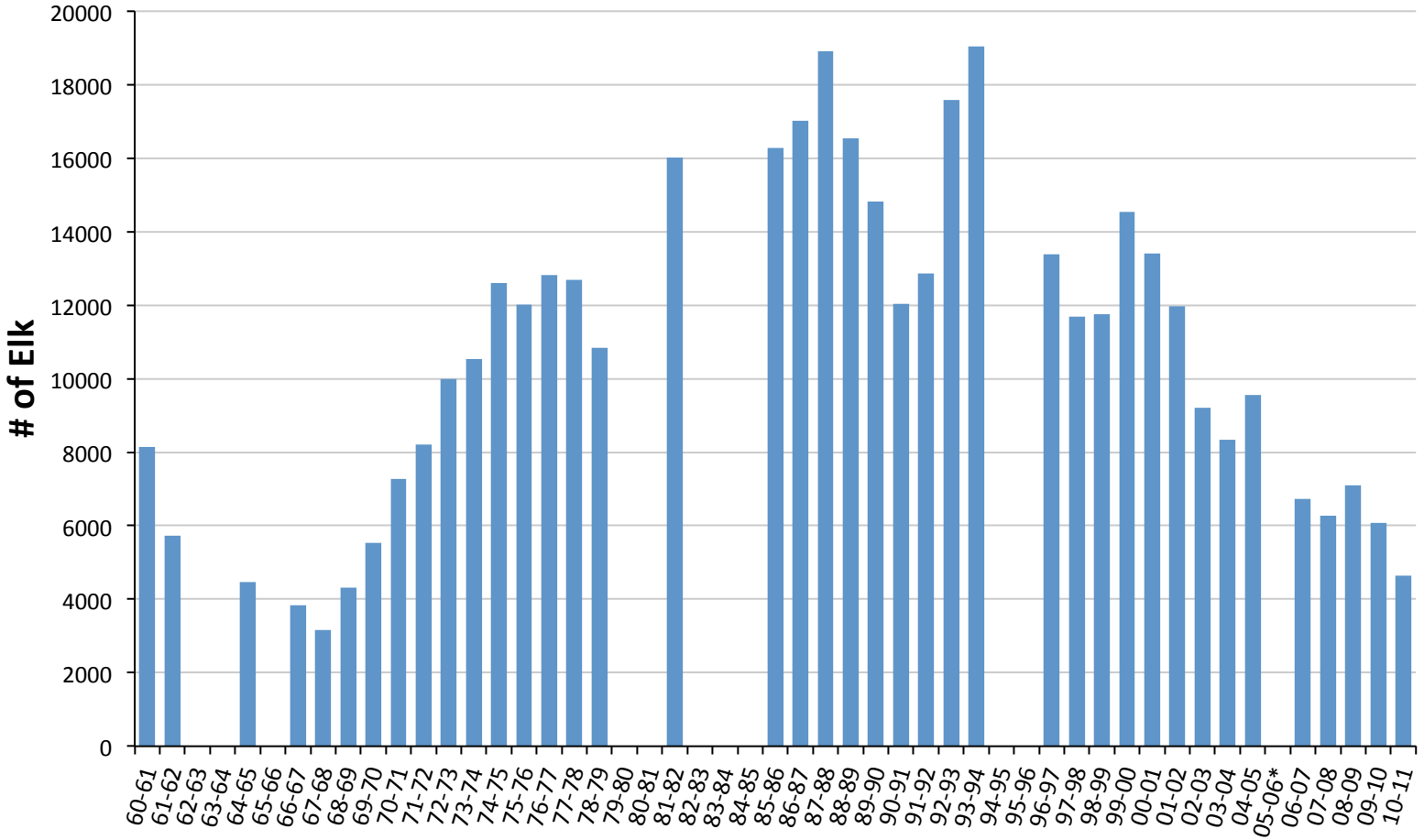




Wilmers et al. 2007 J. Animal Ecology

Northern Yellowstone Cooperative Winter Elk Counts

Compiled by the Northern Yellowstone Cooperative Wildlife Working Group



*** 05-06 had bad survey conditions and were excluded from annual counts; missing years are due to no survey**

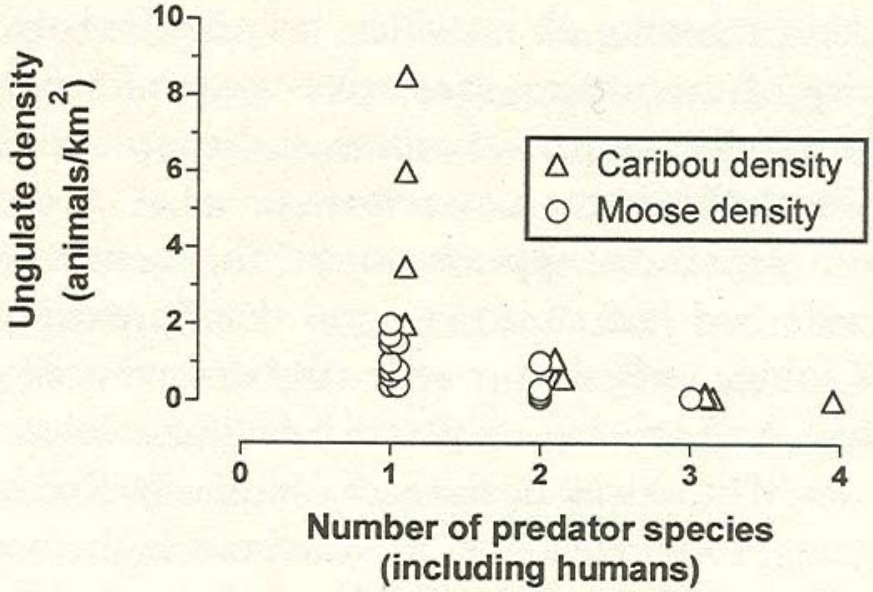


FIGURE 5.11. Ungulate density in relation to the number of predator species present, including black bears, brown bears, wolves, and humans (from Peterson 2001).

Wolf Ecosystem Impacts
Top-down or Bottom-up (or both?)

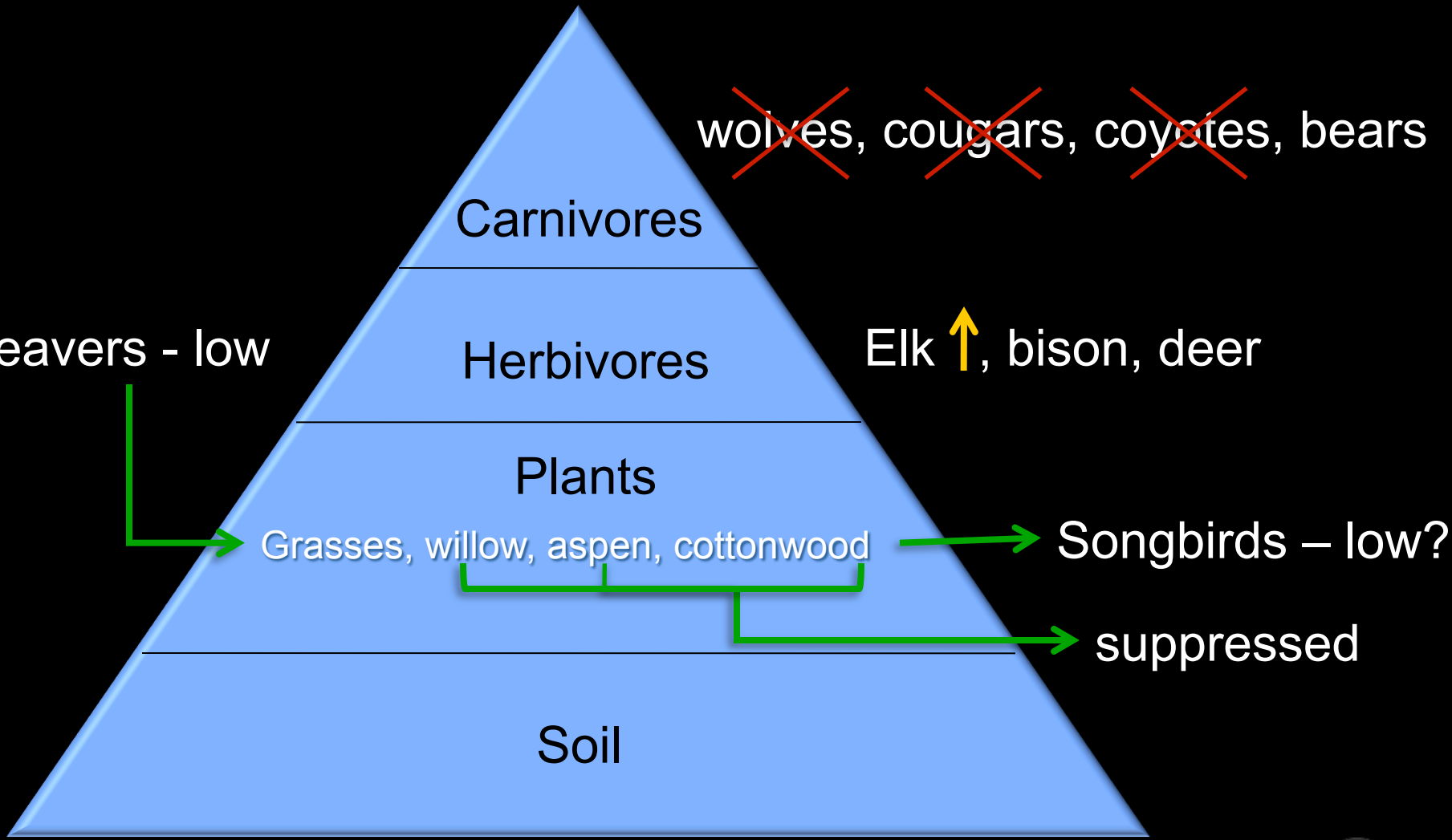
Vegetation
(woody browse)

Behavioral

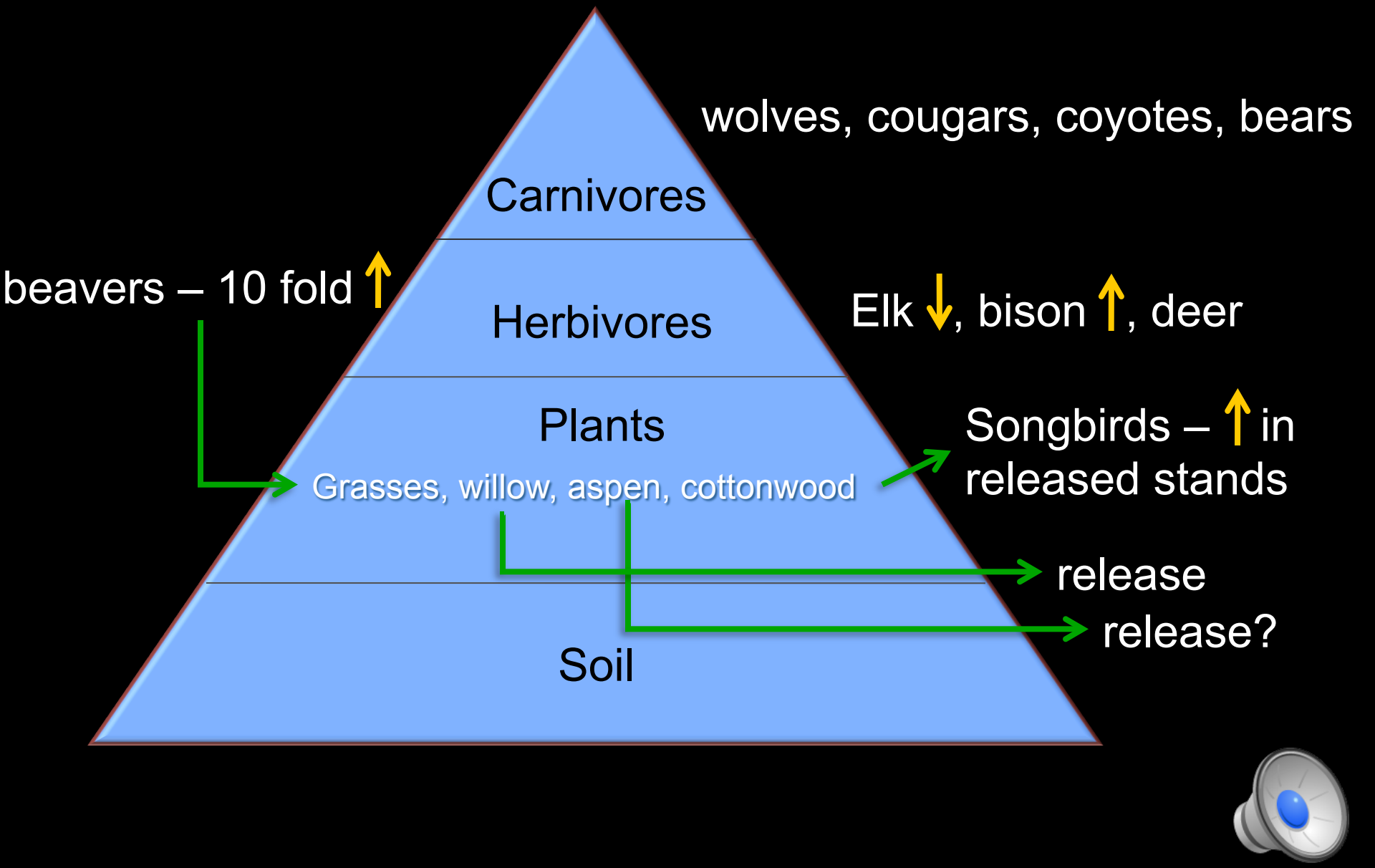
Numeric

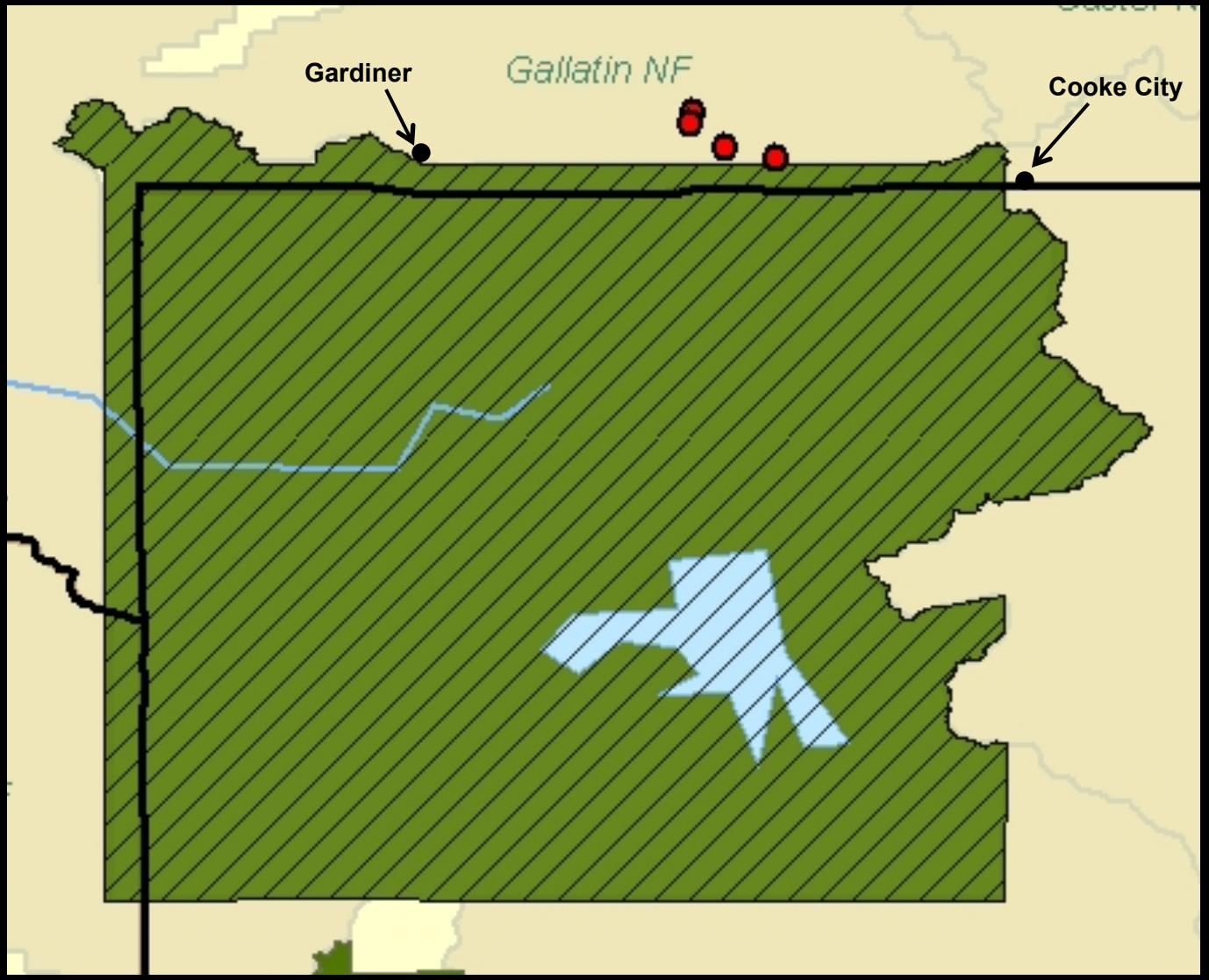
Both?

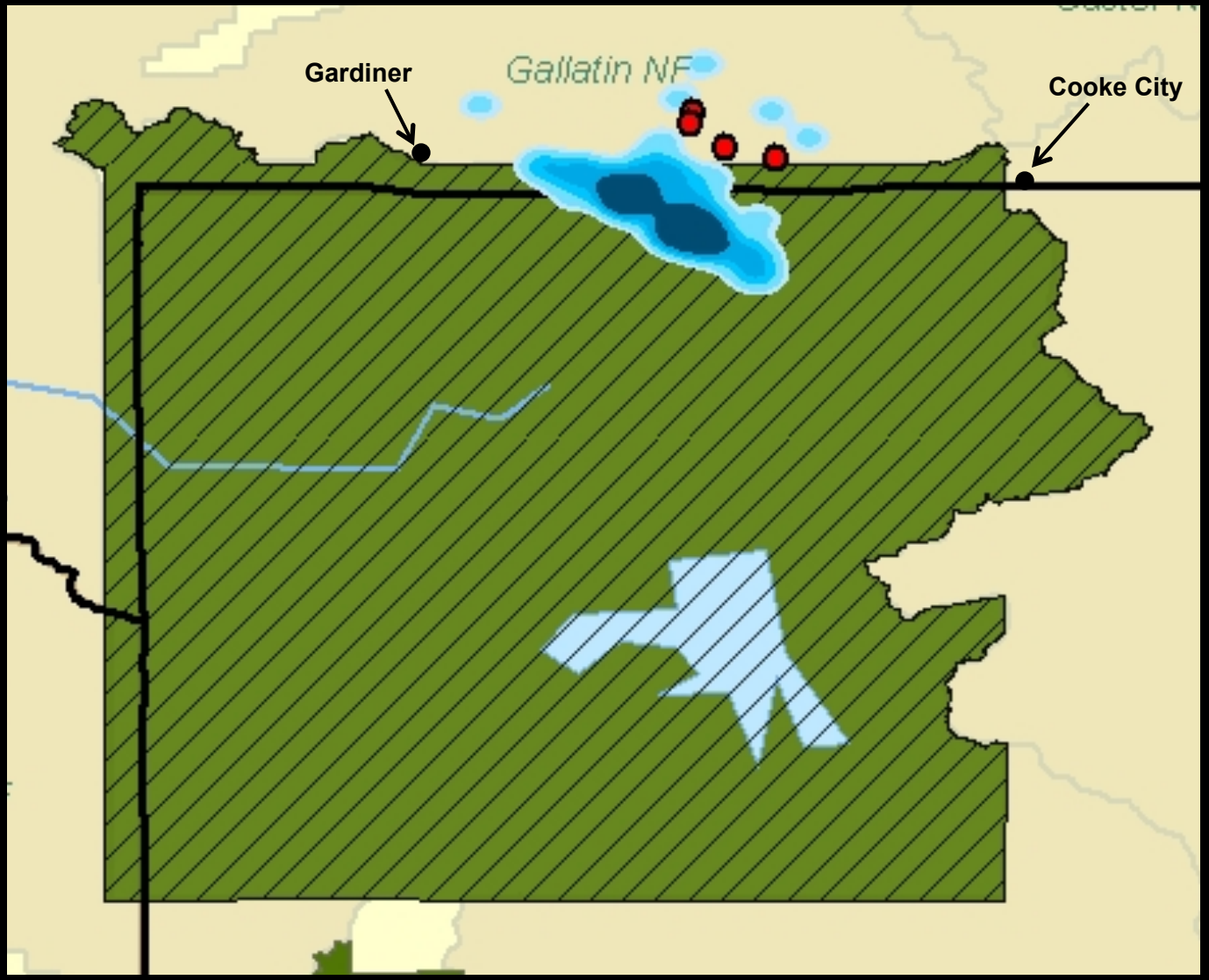
YNP – Northern Range – 1920-30s



YNP – Northern Range – 2000




Gardiner
Gallatin NF
Cooke City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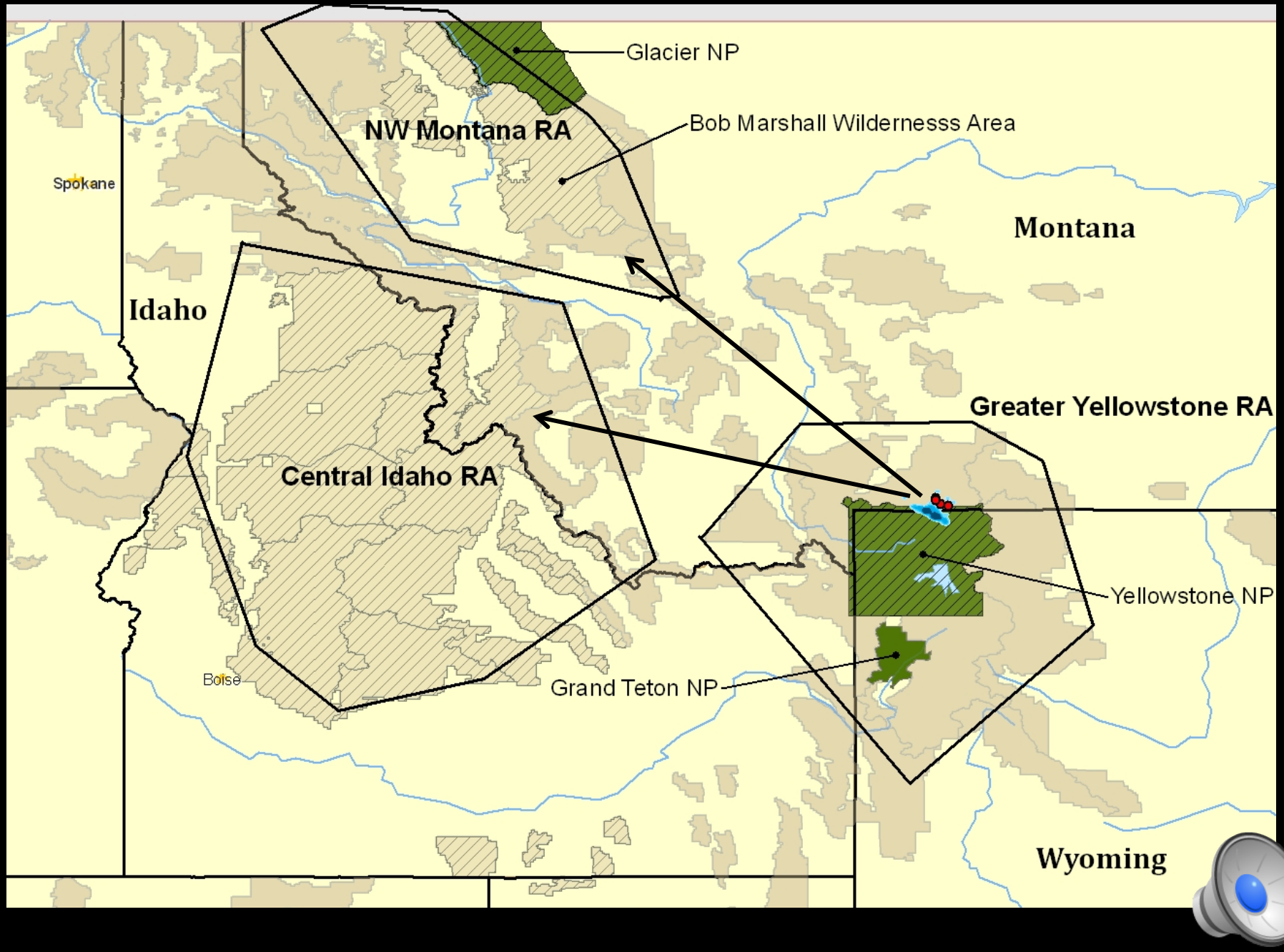
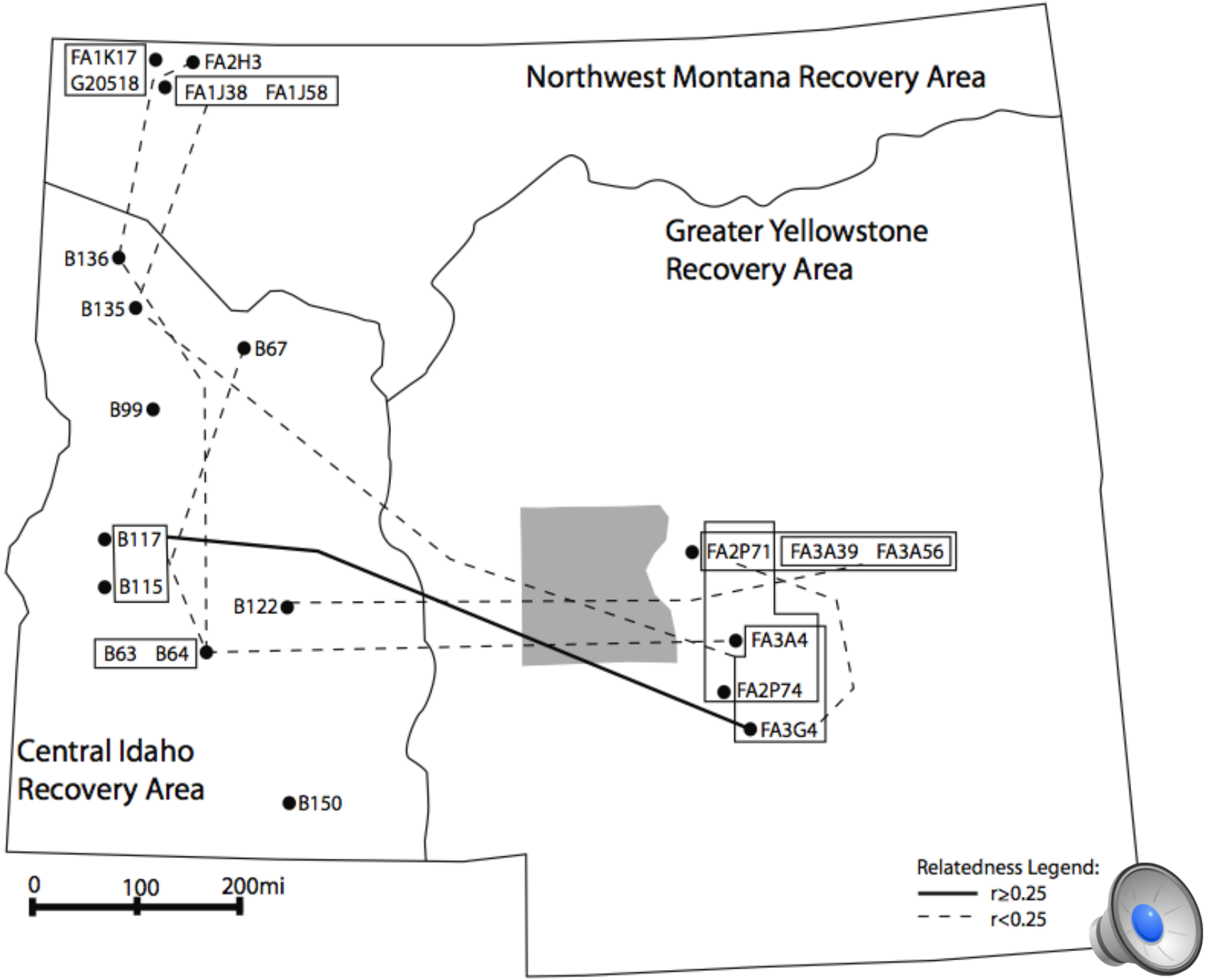
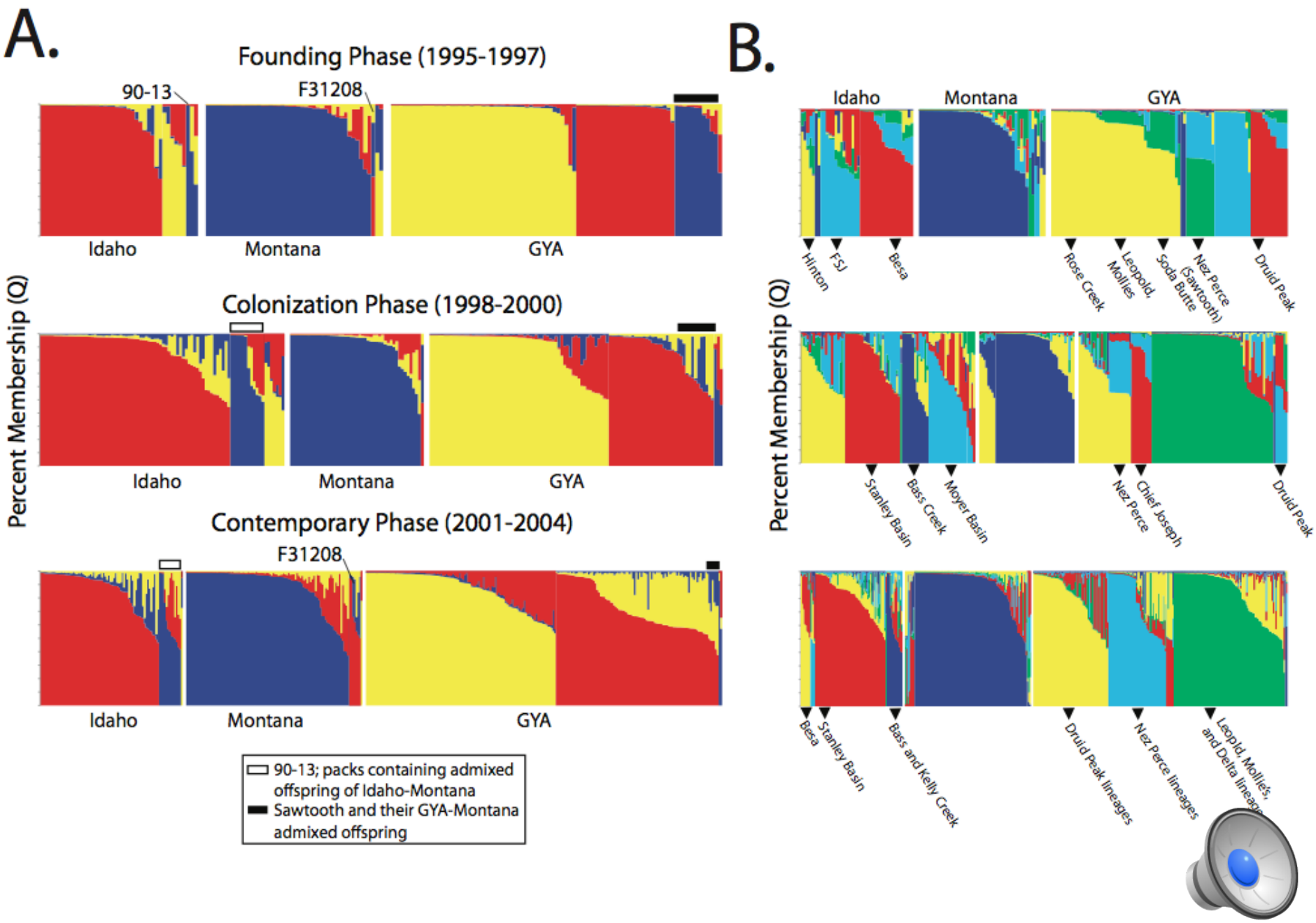
Gallatin NF
Cooke City


Glacier NP
NW Montana RA
Bob Marshall Wildernesss Area
Spokane
Montana
Idaho
Greater Yellowstone RA
Central Idaho RA
Yellowstone NP
Boise
Grand Teton NP
Wyoming


FA1K17
G20518
FA2H3
FA1J38 FA1J58
Northwest Montana Recovery Area
Greater Yellowstone
Recovery Area
B136
B135
B67
B99
B117
B115
B122
B63 B64
FA2P71 FA3A39 FA3A56
FA3A4
FA2P74
FA3G4
Central Idaho
Recovery Area
B150
0 100 200mi
Relatedness Legend:
r≥0.25
r<0.25


A.
Founding Phase (1995-1997)
90-13
F31208
Idaho
Montana
GYA
Colonization Phase (1998-2000)
Idaho
Montana
GYA
Contemporary Phase (2001-2004)
F31208
Idaho
Montana
GYA
Percent Membership (Q)
90-13; packs containing admixed offspring of Idaho-Montana Sawtooth and their GYA-Montana admixed offspring
B.
Idaho
Montana
GYA
Hinton
FSJ
Besa
Rose Creek
Leopold, Mollies
Soda Butte
Nez Perce (Sawtooth)
Druid Peak
Percent Membership (Q)
Stanley Basin
Bass Creek
Moyer Basin
Nez Perce
Chief Joseph
Druid Peak
Besa
Stanley Basin
Bass and Kelly Creek
Druid Peak lineages
Nez Perce lineages
Leopld, Mollés, and Delta lineages

The Danger of Wolves

By Valerius Geist, Ph.D.

Credit: Bente Ryberg

Valerius Geist, Ph.D., is Professor Emeritus of Environmental Science at the University of Calgary in Alberta, Canada.

The overwhelming belief about wolves (*Canis lupus*) in North America is that they are shy, rarely seen creatures that avoid people. I must confess that I, too, used to embrace this view, having been taught such ever since graduate school. This perspective was reinforced during my career as an ethologist, studying ungulates and encountering painfully shy wilderness wolves. Since I've retired, however, a misbehaving pack near my home on Vancouver Island, Canada—as well as a close review of historical data—have taught me otherwise.

Wolves are dangerous predators that, under specific circumstances, do pose a serious threat to people. Although in North America wolf attacks on humans are very few, changing patterns of human settlement and land use coupled with growing and dispersing wolf populations have set the stage for increasing numbers of human-wolf encounters (McNay 2002). Those studying, managing, or working near wolves must be aware of the conditions under which wolves become dangerous.

A Tragic Example

On November 1, 2007, a six-member coroner's jury in Saskatchewan ruled that wolves killed Kenton Carnegie, a 22-year-old honors and scholarship student in geological engineering at the University of Waterloo. The incident occurred on November 8, 2005, in northern Saskatchewan, where Carnegie was participating in a student work program at a work camp at Points North Landing.

After Carnegie's death, his parents asked three scientists to look independently into the case: Mark McNay, then a biologist with Alaska's Department of Fish and Game, Brent R. Patterson with the Ontario Ministry of Natural Resources, and me. We all arrived at the same conclusion, that wolves killed Kenton Carnegie. At the coroner's inquest only one expert witness was allowed to testify on behalf of the Carnegies, and the court chose McNay. The jury agreed with our findings, and dismissed the assertion that a black bear was responsible, which had been reported in popular news outlets.

Wolves may habituate to and target humans as prey in the same manner as coyotes (*Canis latrans*) in urban parks when targeting children (Baker and Timm 1998). Both canids explore humans very cautiously and over a protracted period before mounting the first exploratory attack. Such an attack occurred four days prior to Carnegie's death. According to police reports, two camp workers encountered two wolves acting aggressively outside the camp. The young men, who reportedly felt threatened by the wolves, used branches to keep the animals at bay and photographed them.

The Eurasian Experience

The tragedy in Saskatchewan may have been unusual for North America, but wolf attacks on humans have been recorded in Russia, Finland, Scandinavia, Germany, India, Afghanistan, Korea, central Asia, Turkey, Iran, and Greenland. I have concluded, along with others, that North American wolves have been less dangerous than Eurasian wolves because the former were consistently persecuted—by hunting, trapping, and poisoning—in the early- and mid-20th century, causing them to avoid humans. But conservation legislation enacted since then has ensured that continuous harassment has not occurred in many areas of North America for several decades.

The "harmless wolf" myth can be traced to a well-regarded Canadian biologist, C.H.D. Clarke, a former chief of the Fish and Wildlife Branch in the Ontario Department of Lands and Forests. Clarke investigated whether reports of dangerous wolves in Europe and Asia were real. He concluded that the killing of people by wolves in Europe did occur, but he blamed rabid wolves for all the attacks.

I believe, however, that Clarke's analysis was flawed. He not only failed to take into account the differences between attacks by rabid and by non-rabid wolves, but also used his personal experience with North American wolves, not the historic record, in his conclusion. In historic times, anyone bitten by a rabid wolf was doomed to death. (In modern times quick medical intervention can save the victim.) Clarke failed to notice that any survivor


N482TJ

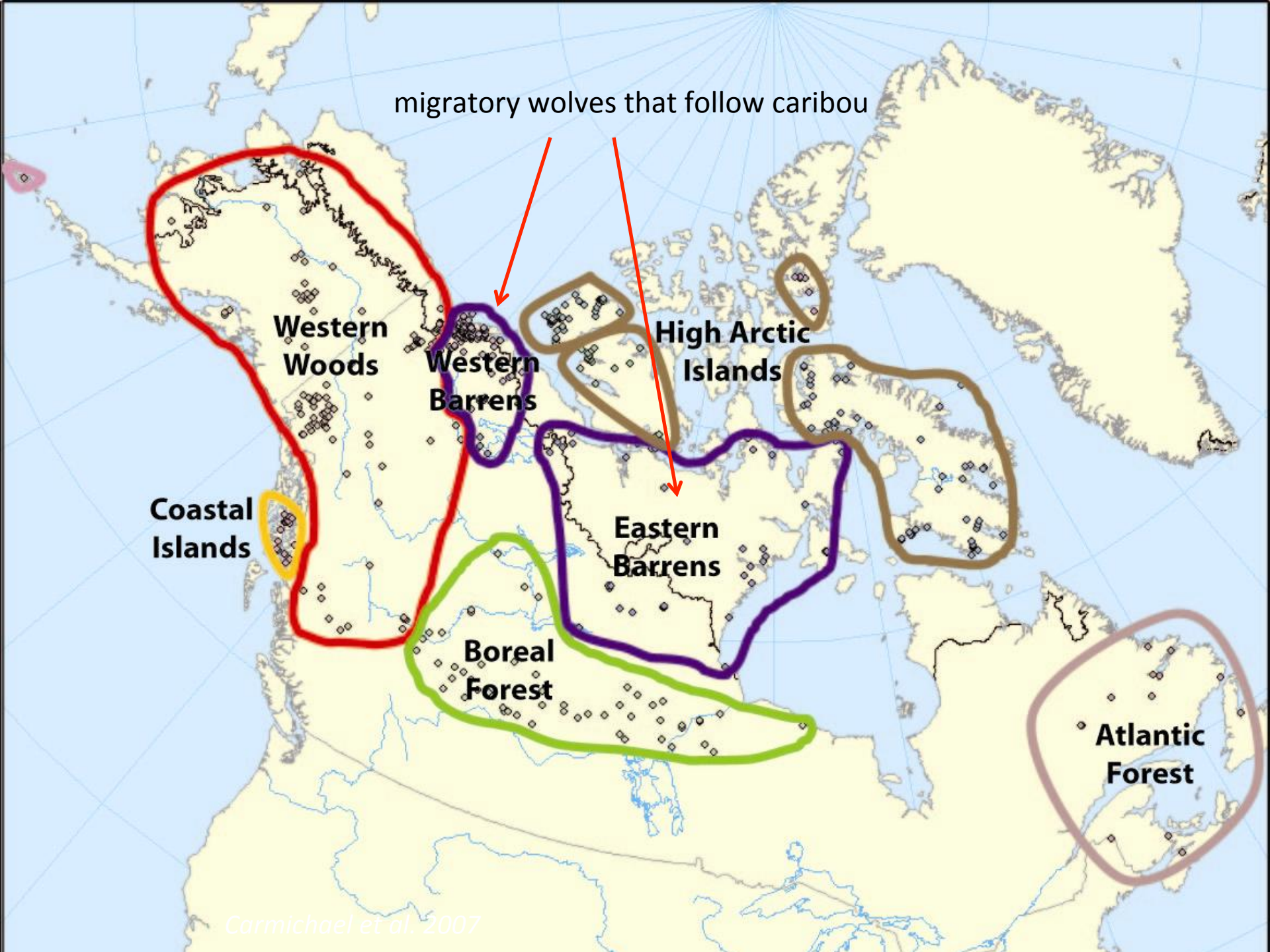

N482TJ

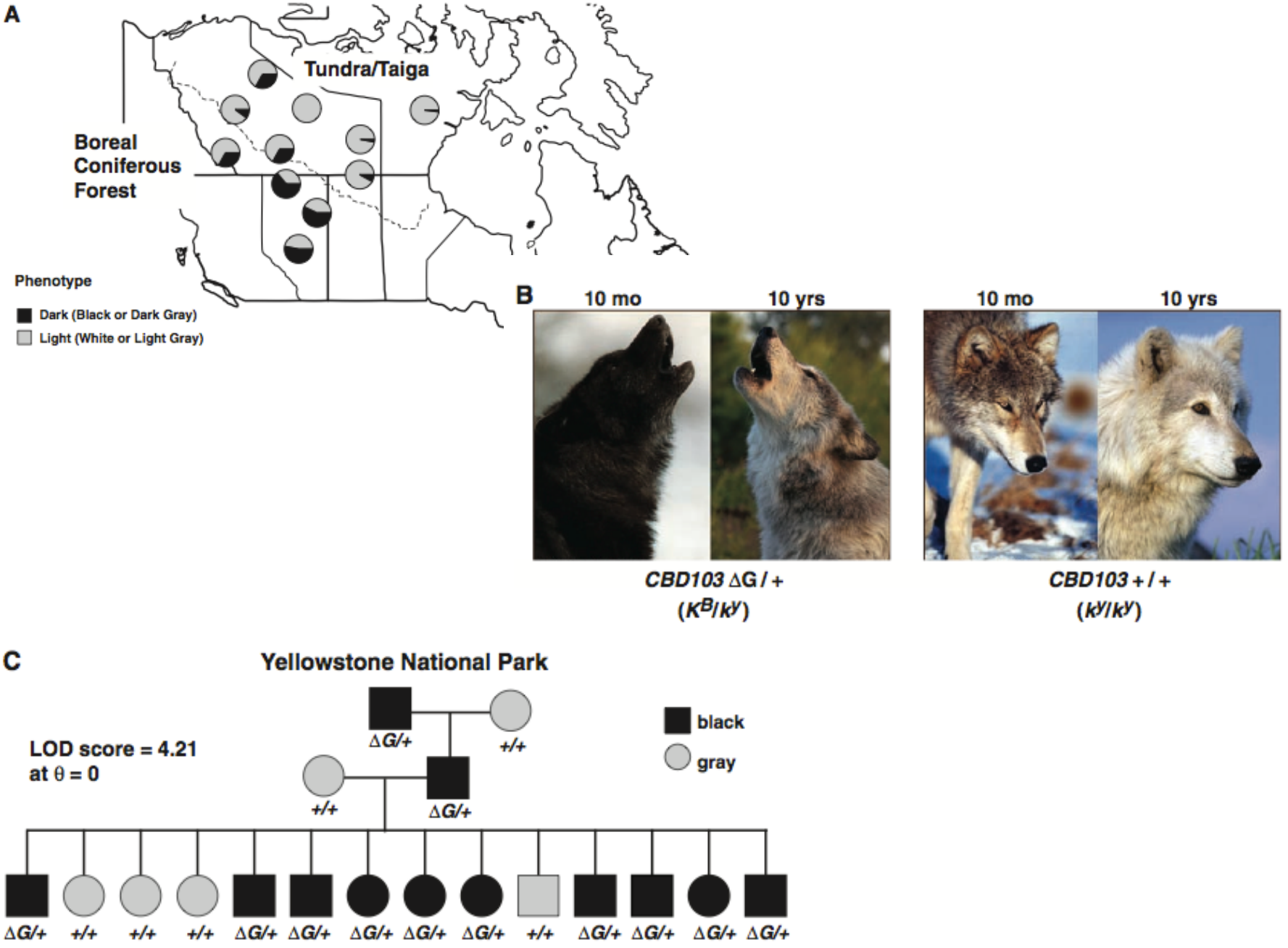

Look on face = Priceless
Lotek GPS Collar = $4,500

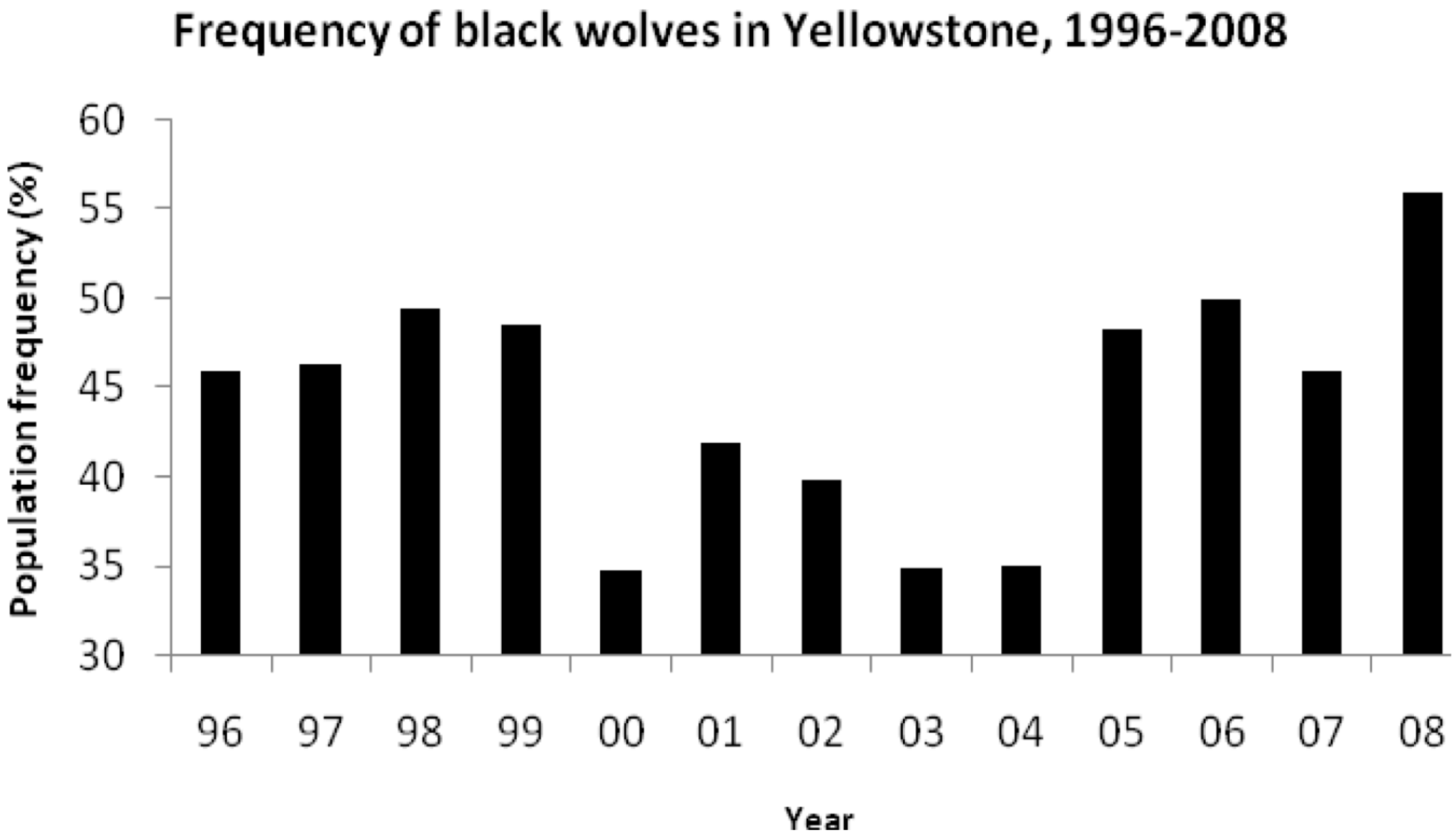

N482TJ

Issues

1. Wolf Population
   - Continued Decline?
   - Delisting
2. State Hunting Seasons
3. Disease
   - Distemper & Mange
   - Introduced disease?
4. Climate Change
5. Wolf Affects on Elk
   - Hunting Issues

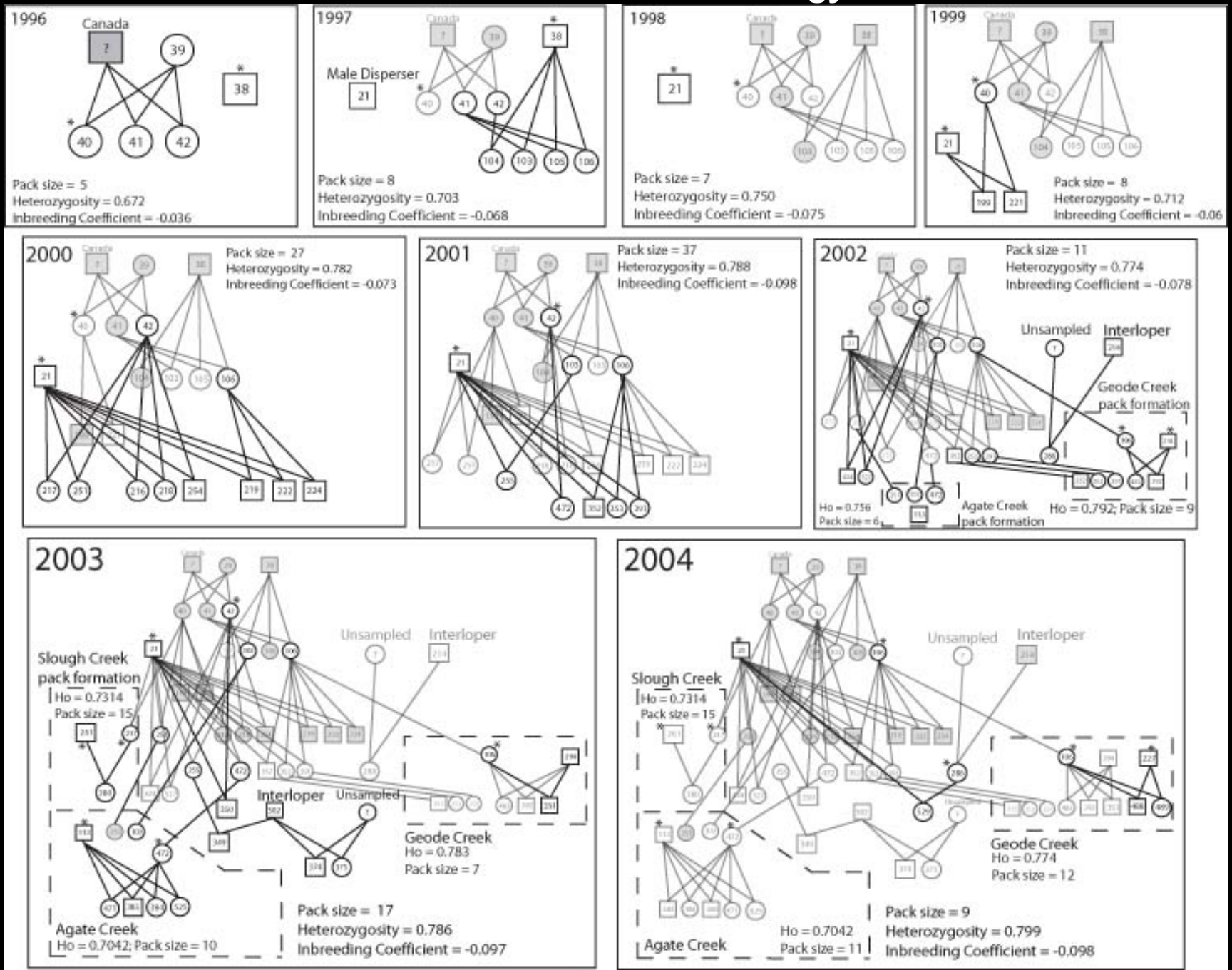

migratory wolves that follow caribou
Western Woods
Western Barrens
High Arctic Islands
Coastal Islands
Eastern Barrens
Boreal Forest
Atlantic Forest
Carmichael et al. 2007


A
Tundra/Taiga
Boreal
Coniferous
Forest
Phenotype
Dark (Black or Dark Gray)
Light (White or Light Gray)
B
10 mo
10 yrs
10 mo
10 yrs
CBD103 ΔG / +
(K^B/k^y)
CBD103 + / +
(k^y/k^y)
C
Yellowstone National Park
LOD score = 4.21
at θ = 0
black
gray
ΔG/+
+/+
+/+
ΔG/+
ΔG/+ +/+ +/+ +/+ ΔG/+ ΔG/+ ΔG/+ ΔG/+ ΔG/+ +/+ ΔG/+ ΔG/+ ΔG/+ ΔG/+

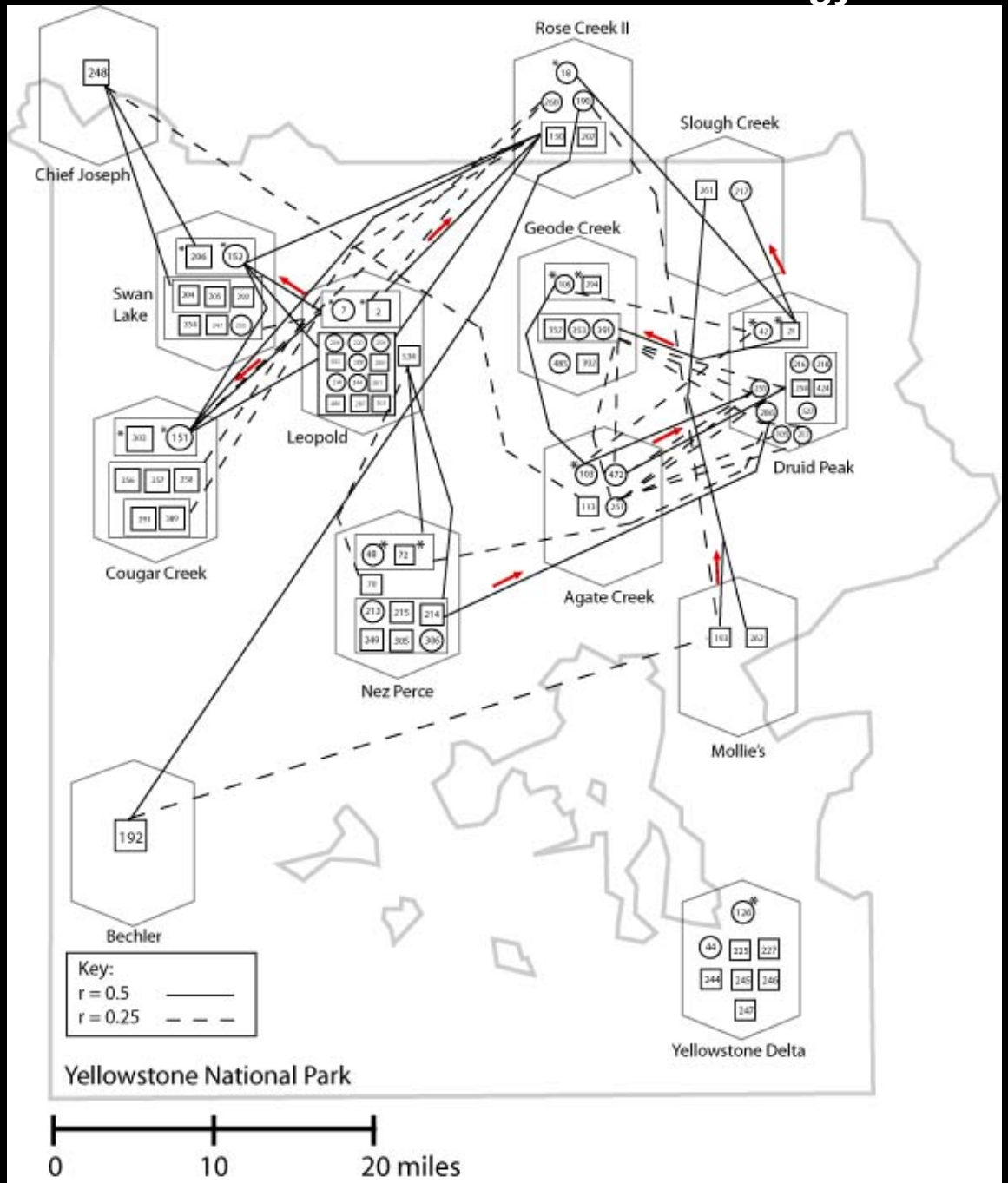

Frequency of black wolves in Yellowstone, 1996-2008
Population frequency (%)
60
55
50
45
40
35
30
96
97
98
99
00
01
02
03
04
05
06
07
08
Year

Close-up of Infection and tooth loss – 8M

Druid Peak Pack Genealogy



2002 Yellowstone Wolf Genealogy



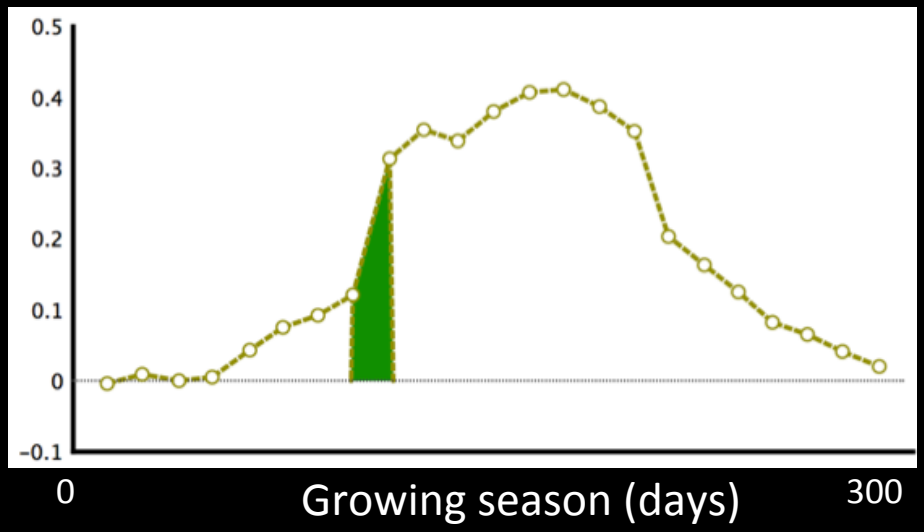

502 ?
Wolf #502
YELL 13Φ903

YELL - #483F
healed bite injury – likely grizzly

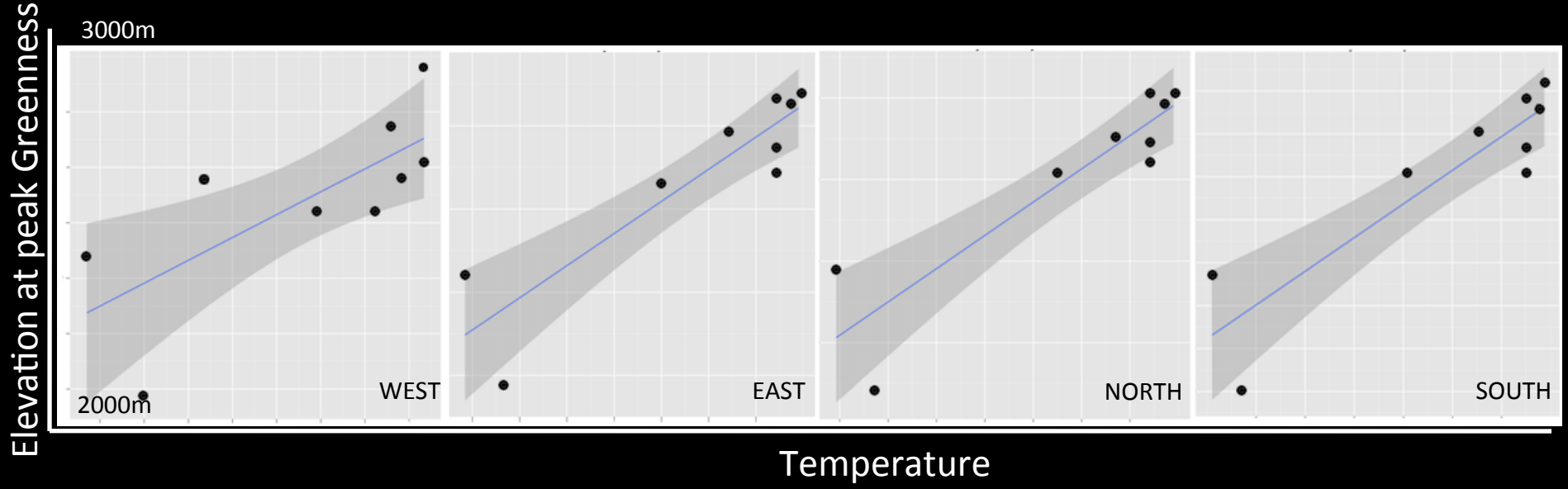
Wolf Relisting & YNP

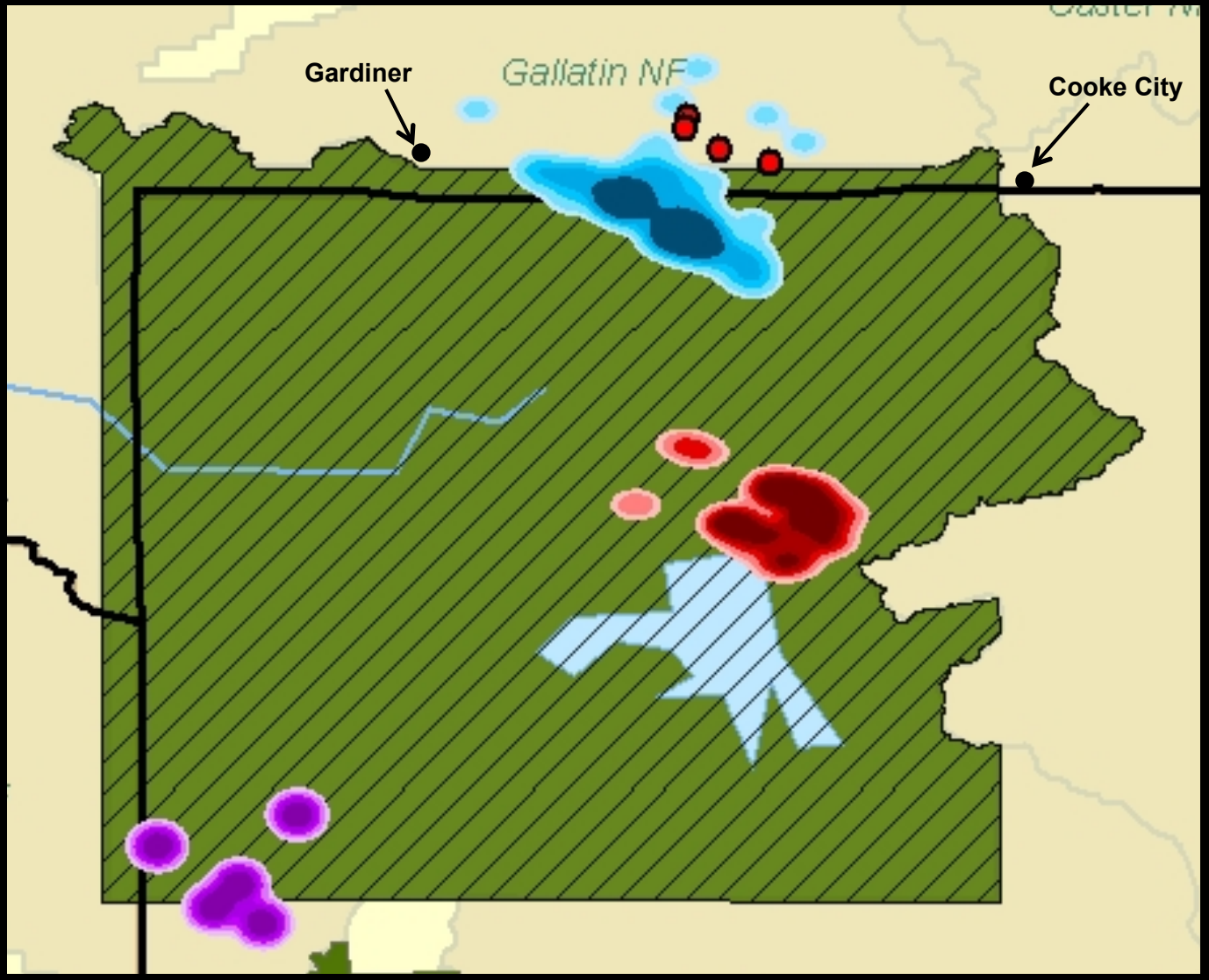
- Management of wolves in YNP unaffected by listing status
- Boundary Issues
  - Source/sink dynamic
  - Packs ranging mostly inside YNP subject to harvest?

Effects of warming on summer green wave in YNP

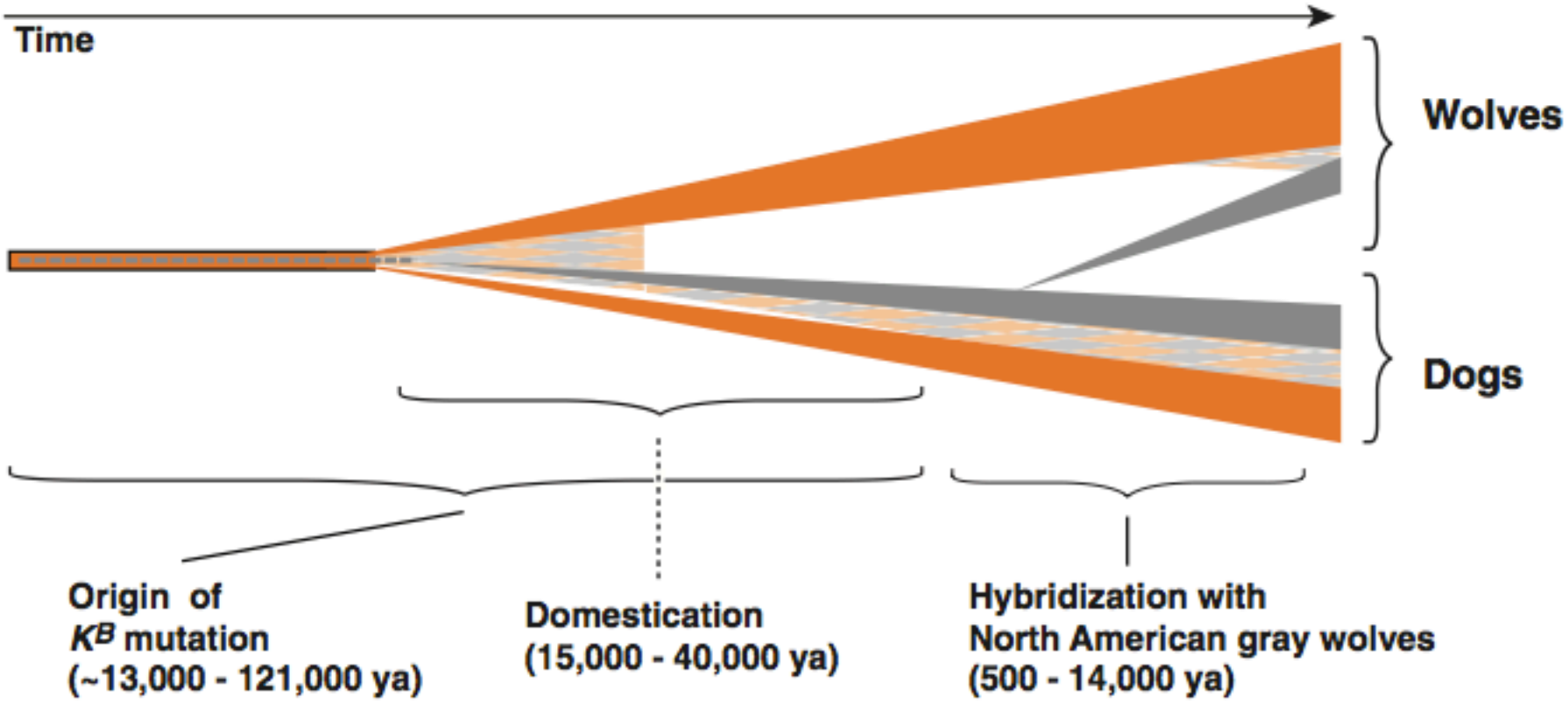


Warming increased the mean elevation at which peak greenness occurred consistently across all slopes between 2000-2008.

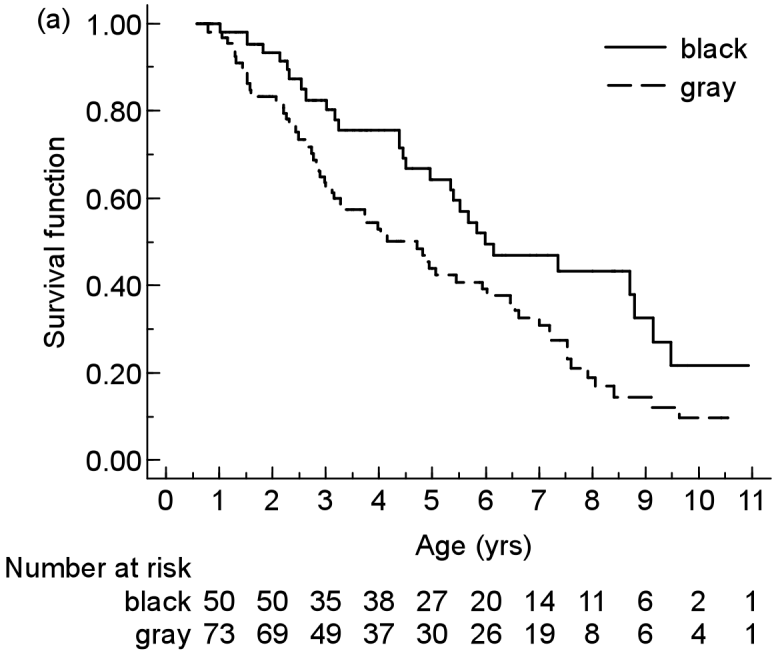


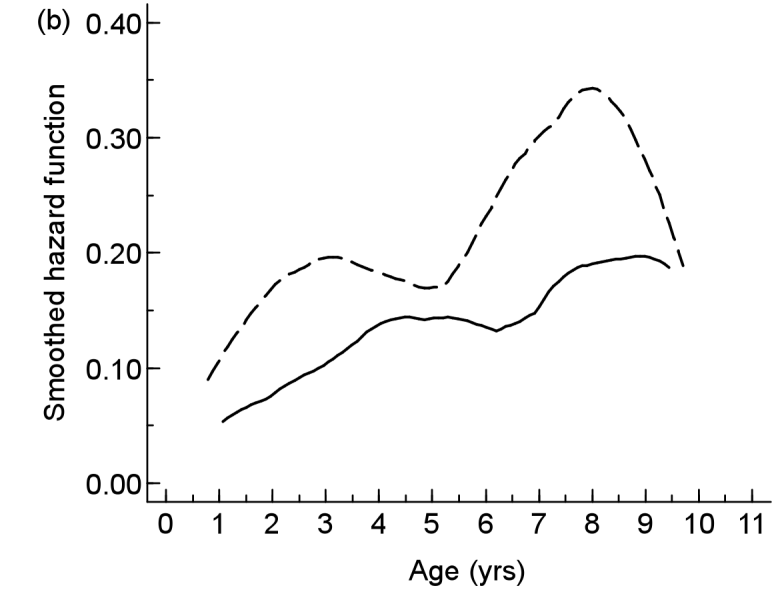

Gardiner
Gallatin NF
Cooke City

Timeline scenario for K locus evolution in dogs and wolves

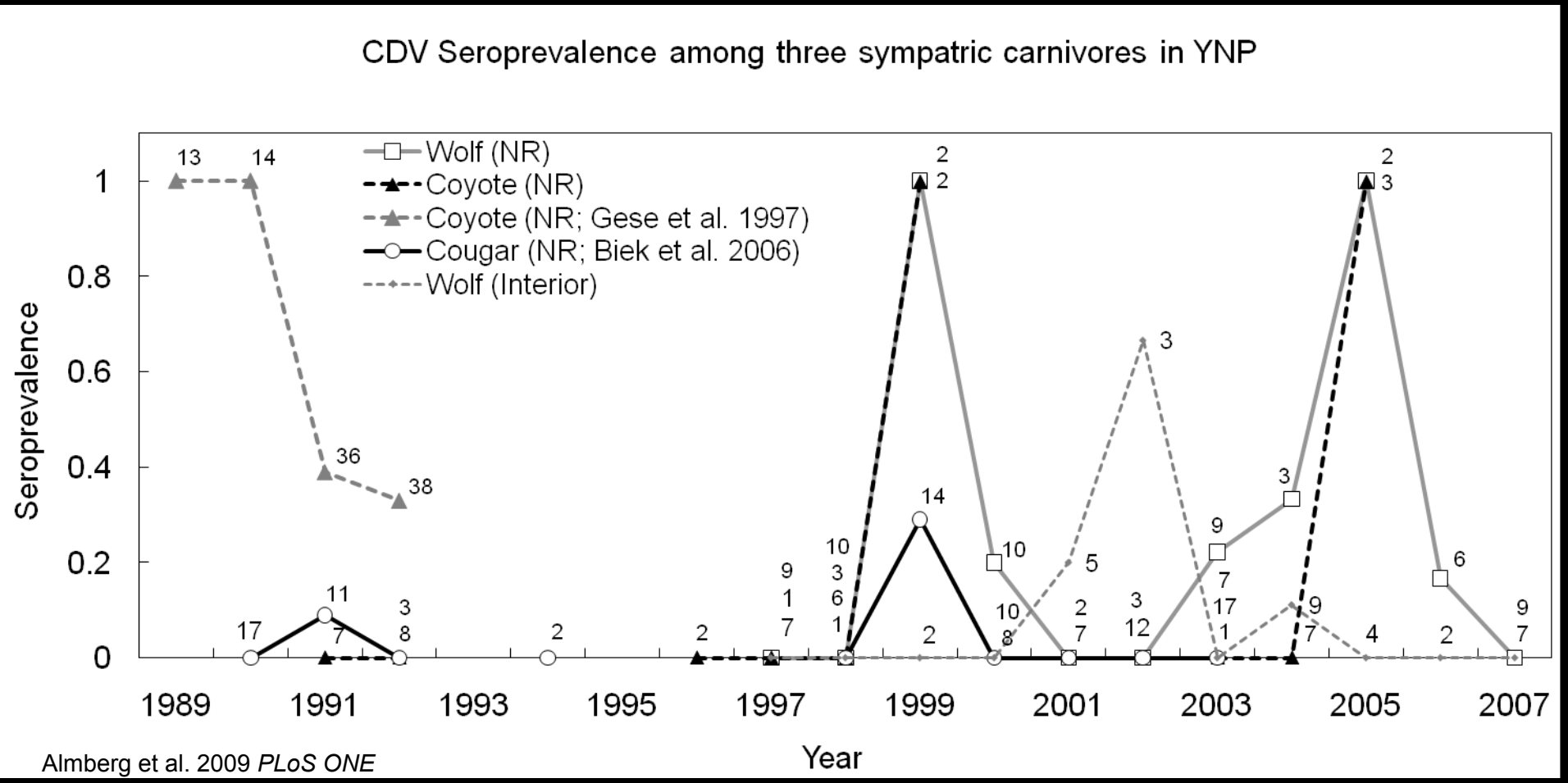


The k^y-to-K^B mutation may have overlapped or even predated domestication, but introgression of K^B into N. American wolves is more recent.





Effects of coat color on survival (a) and probability of death (b) for 266 radio-marked wolves (≥ 0.75 yrs-old) in Yellowstone National Park, 1998-2009.



Almberg et al. 2009 *PLoS ONE*